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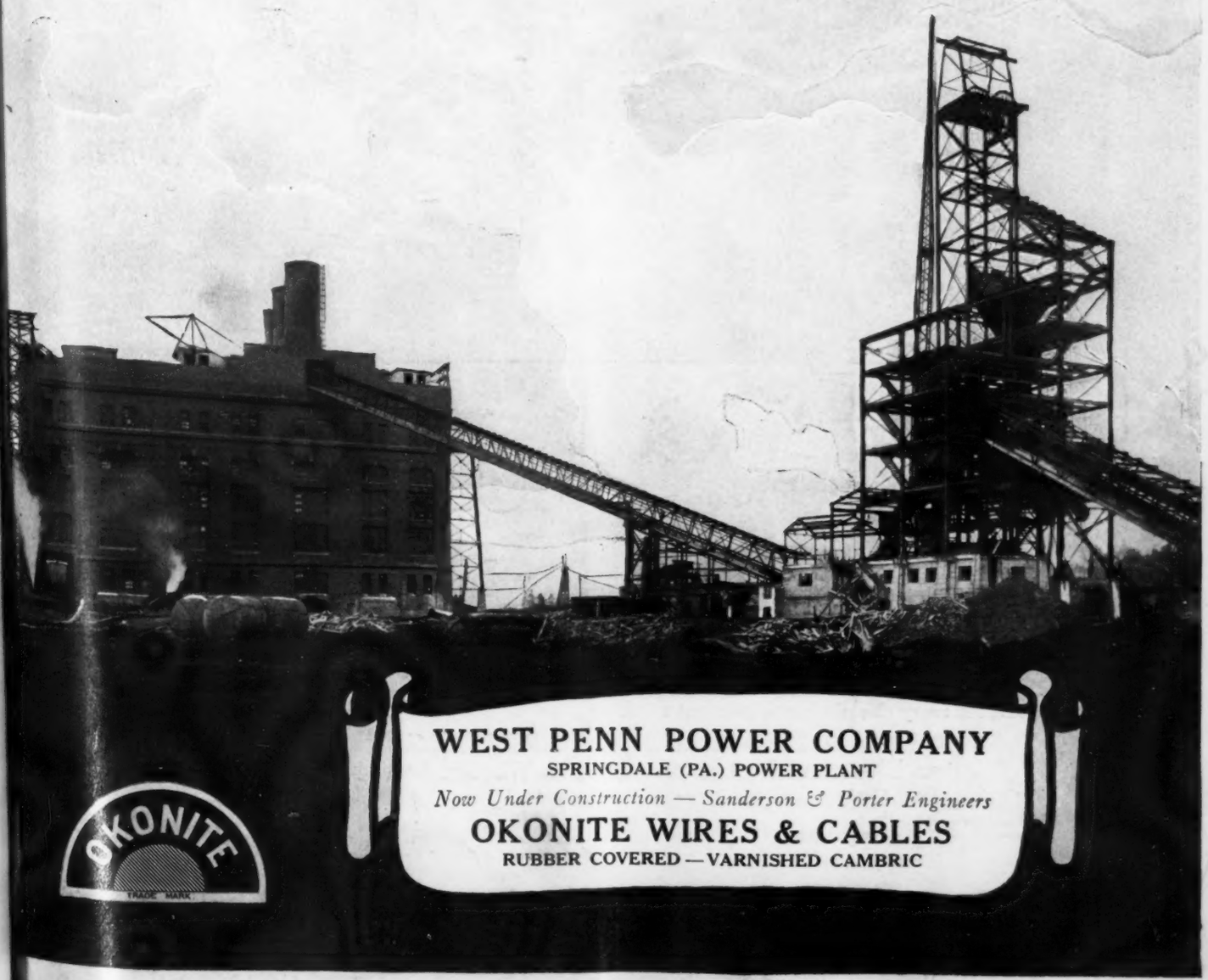
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# Electrical World

*The consolidation of Electrical World, Electrical Engineer and American Electrician*
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## A Census of Distribution

EXPRESSION was given to an eminently practical idea by Edward N. Hurley when in his paper before the Indianapolis convention of the Associated Advertising Clubs of the World he suggested that the national government should take a census of the jobbing and retailing industries of the country in the same way that it does of the manufacturing industries. Mr. Hurley pointed out that there are no statistics on distribution corresponding to those on production, although distribution is far more important to the consumer. The cost for such a survey, in his opinion, would be small compared with its benefits. Assuredly if it led to the detection of the real profiteers while acquitting those unjustly accused it would be welcomed with popular acclaim.

## Uneconomical Operation as Costly as Bad Management

EXCEPT that it can be corrected, uneconomical operation of a plant is as costly as bad management, yet too few companies consider both conditions from their true aspects of unfairness to investor and consumer. Some of the more progressive companies are adopting every method that will improve economy sufficiently to warrant the investment, but there are still instances where economies are yet to be made that only an intensive study and analysis of operating results can reveal. In the same way that the shrewd business man in other industries finds ways to spend one dollar to get back a dollar and a quarter, so in the operation of public utility plants there are opportunities for such an investment in the station and along the line. Obsolete equipment, deferred maintenance, heat losses in steam lines, wattless energy that limits maximum load on generators and kindred subjects demand attention in plants both large and small from the standpoint of ascertaining what records are necessary to study the possible economies, what facilities are needed to obtain these records and, after analysis, what basis should be used to evaluate the economies. For the average company such information is the greatest operating need of the present day, a need which can be supplied only by corporate effort and willingness to publish findings both good and bad.

## Standardized Tests for Home Electrical Devices

IN THE report of the standardization and testing division of the Merchandise Sales Bureau presented at the National Electric Light Association convention emphasis was placed on the need of standardized tests for electrical household devices. The objects of this committee are constructive and its recommendations have been approved by the Heating Appliance Section of the American Manufacturers of Electrical Supplies. The need for the proposed tests is shown by the committee through the statement that out of eighty-two devices offered to one particular central station forty-one were rejected after being tested. However, it would be a great waste of time and money for every central station to conduct its own testing laboratory for devices of this kind, and it would be annoying and most uneconomical to compel manufacturers to make their devices pass the tests specified by different central stations. Still, at the present time the great majority of central stations, contractors and dealers simply use their own judgment as to whether or not a device will stand up in service. The ultimate consumer knows nothing about the subject, and as most of the dealers from whom he can buy the apparatus are not in a position to speak with authority as to the merits of the many devices now being sold, some method must be worked out to protect the public against devices poor in quality and service. This is a problem that cannot be solved by the central stations alone; it requires the co-operation of all interested in the establishing of a method whereby an authoritative stamp of approval can be placed on those devices that have passed searching standard tests.

## A Pocket Veto That Needs Explanation

WATER-POWER development has met another setback, as unnecessary as it was unexpected. Among the legislative provisions in the United States Constitution is one to the effect that an act duly passed by both houses of Congress and not vetoed by the President within ten days (excluding Sundays) from the date of its presentation to him shall become law without his signature, provided that Congress shall not have adjourned in the meantime. The water-power bill passed the Senate on May 28. Congress adjourned on June 5. The President did not sign the bill, and for the present it is dead. Had Congress remained in session only three or four days longer, it would now be law with or without Mr. Wilson's signature unless he had vetoed it in that space of time, and in that case the majorities it had already received—259 to 30 in the House and 45 to 21 in the Senate—would have been more than ample to repass it over the veto. Again, had Congress taken a recess instead of an adjournment, only a speedy veto could have prevented the measure becoming law, and in the event of a veto it could have been passed again immediately on reassembly.

Why did not the President sign the bill? The best information obtainable at this writing is to the effect that, finding it impossible in his enfeebled state of health and with the rush of work thrown on him by the precipitate adjournment to give the measure in its final form the careful scrutiny that was his duty, he referred

it to the three members of his Cabinet who under the terms of the bill would form the first national water-power commission. Secretary of War Baker and Secretary of Agriculture Meredith are said to have approved it, but the new Secretary of the Interior, Mr. Payne, if report be true, maintained that the national parks were not protected by the proposed legislation. Influenced, it is said, by Mr. Payne's opinion, the President allowed the bill to die. If this report be accurate—and the ELECTRICAL WORLD is not vouching for it—Mr. Payne has incurred a very heavy responsibility unless he can make it clear to the nation that at the eleventh hour and fifty-ninth minute he discovered a real, tangible defect that had been indiscernible by all the astute minds before which the provisions of the bill had previously come. For, whatever wild charges may be made against the outside advocates of water-power development, who will accuse its Congressional and executive sponsors of a willingness to injure the national parks?

A keener sense of its obligations, it seems to us, would have kept Congress in session—or at least have substituted a recess for an adjournment—until the President had signed, vetoed or allowed to become law without his signature this and other measures that met the same fate. The fiasco shows clearly that the Congressional agents of the American people were more interested in the Chicago and San Francisco conventions and in repairing their own private political fences—possibly even in their mileage allowance—than in seeing through the tasks with which their constituents intrusted them. The episode, the joint product of fate and politics, is one more added to the farces, comedies or tragedies—as one chooses to view them—that are yearly enacted under the dome of the Capitol. A speedy repassage of the bill when the Congress reconvenes in December, with an amendment to protect the parks if Mr. Payne shall succeed in making his alleged objection good, and its prompt enactment into law, with or without the Presidential approval, now becomes the objective of the friends of water power. In the meanwhile the national election will take place, and the fate of water-power development will not be the least of the issues that will shape its outcome.

## Industrial Lighting Intensities

APPARENTLY the maximum of industrial lighting intensities has not been reached, nor will it be reached until each industry has collected more data from which to obtain the relation between high intensities and production efficiency. While in making changes from a high intensity to one even higher the lead must be taken by industrial plants themselves, and the conclusions be based on observation of particular operating conditions, the central station can do much to promote a thorough understanding of the value of lighting in relation to productive efficiency.

In a very instructive article elsewhere in this issue O. R. Hogue has pointed out how the Commonwealth Edison Company of Chicago is aiding in this campaign. In a typical machine shop layout actual working conditions are very closely approximated and the lighting units are arranged so that seven combinations may be obtained with a variation of from 3 to 114 foot-candles. The machine shop is in actual operation, giving an opportunity for observation of the effect of lighting on the work. In this way the effect of glare and the application of diffused and directional lighting is strikingly shown. Twenty-four foot-candles was determined as the best productive intensity in this case. However, installations of 50 foot-candles intensity are now in use and with excellent results where the design is such as to eliminate glare. Each year sees a development toward making artificial lighting compare very favorably with daylight, and it is quite possible that in the near future production under high lighting intensities will be fully the equal of that under natural light.

## The Federated American Engineering Societies

LAST week at Washington, D. C., as reported in this issue, the engineers of this country set up a form of federation of engineering and allied technical professions that is both unique and far reaching in its influence. In the public affairs of the city, the state and the nation, where engineering experience and technical knowledge are involved, the engineer has through individual service in his chosen field gained a high order of recognition. Through the engineering organizations, national and local, he has likewise established a high standard in engineering and technical matters. However, the influence of these group organizations has never been adequately developed or utilized in matters of state or in social matters relating to the welfare of the engineer and the development of his profession. This new and larger work the federation will initiate and conduct with the joint interest and support of engineers as a class irrespective of the particular branch of engineering they may represent or be affiliated with.

Before calling the conference in Washington it was known that the proposed federation as an all-embracing organization, with membership formed by existing engineering societies rather than by individuals, would overlap in some measure the work of the American Association of Engineers, which is a growing society, built up on individual membership and for the advancement of the engineer and his profession. In the deliberations of the conference that organization was represented and showed a spirit of co-operation that was most admirable and won great praise from the entire delegation. In being the first to vote in the affirmative on the fundamental principle of the federation, that it should be an organization of societies and affiliations and not of individuals, the American Association of Engineers effectively removed any feeling of antagonism toward the new movement which might otherwise have existed and, besides, made the vote of the fifty-two societies represented unanimous. In the debate on the adoption of the constitution the same spirit of co-operation was displayed, but the A. A. E. emphasized its desire to function independently along welfare lines. Although it did not vote on the constitution, the way for an affiliation as a member is still left open to that organization, since the vote or non-vote of the delegates did not commit the body represented. There is ample room for both the A. A. E. and the new federation to perform their work either separately or by affiliation through membership. However, the greatest good will come through affiliation. It is hoped that when the permanent organization is created and functioning a mutually satisfactory basis for co-operation on a society basis of membership in the federation can be established.

The scope of the constitution of the Federated American Societies reflects the broad viewpoint of the large committee to which its form was intrusted. Through it the management of the organization is vested in a body to be known as the American Engineering Council, and it will be under this name that the work of the federation will be generally known. While this council will consist of representatives of member societies and be a large body, formed on the basis of one representative for a membership of 100 to 1,000 inclusive and one additional representative for every 1,000 members, provision is wisely made for an executive board to consist of thirty members of the council charged with the conduct of the business of the organization under the direction of the council.

Another provision of the constitution which is contained in few such documents is an article providing for open meetings, a wide publicity for the results of deliberation and full co-operation with the technical and general press of the country. This particular provision applies a remedy for many of the ills of the national organization and effectively overcomes the reticence that has kept from the general public knowledge of much of the good work for which engineers as a group have been responsible. It also opens the door to co-operation on the part of the technical press on the basis of mutual interests in the problems undertaken and makes effective use of the agencies that exert a powerful influence through the thousands of engineers included among their readers.

Engineers everywhere should realize the magnitude of this organization movement on their behalf. It is not enough to indorse it. There is an obligation of affiliation and support, for from its work there will be a return far in excess of the small cost which the breadth of the plan makes possible.

## Electric Versus Steam Drive for Auxiliaries

AN INTERESTING study of the relative economy of driving station auxiliaries by motors and by steam derived somewhere from the plant is presented in this issue by E. E. George. Many opinions have been expressed on this subject, and practice varies in a way that suggests very forcibly that the matter still is somewhat indeterminate. Considering the situation in broad terms, electric drive has the advantage by reason of the fact that the efficiency of utilization of steam is enormously greater in the large main turbines than in small turbines or reciprocating engines, although the exhaust steam can sometimes be used for heating to full advantage. There is a good deal to be said for its use, but when it comes to heating the feed water the question raised by Mr. George is whether it is not desirable to bleed an intermediate stage to the turbine sufficiently for this use and to work the auxiliaries entirely by motors.

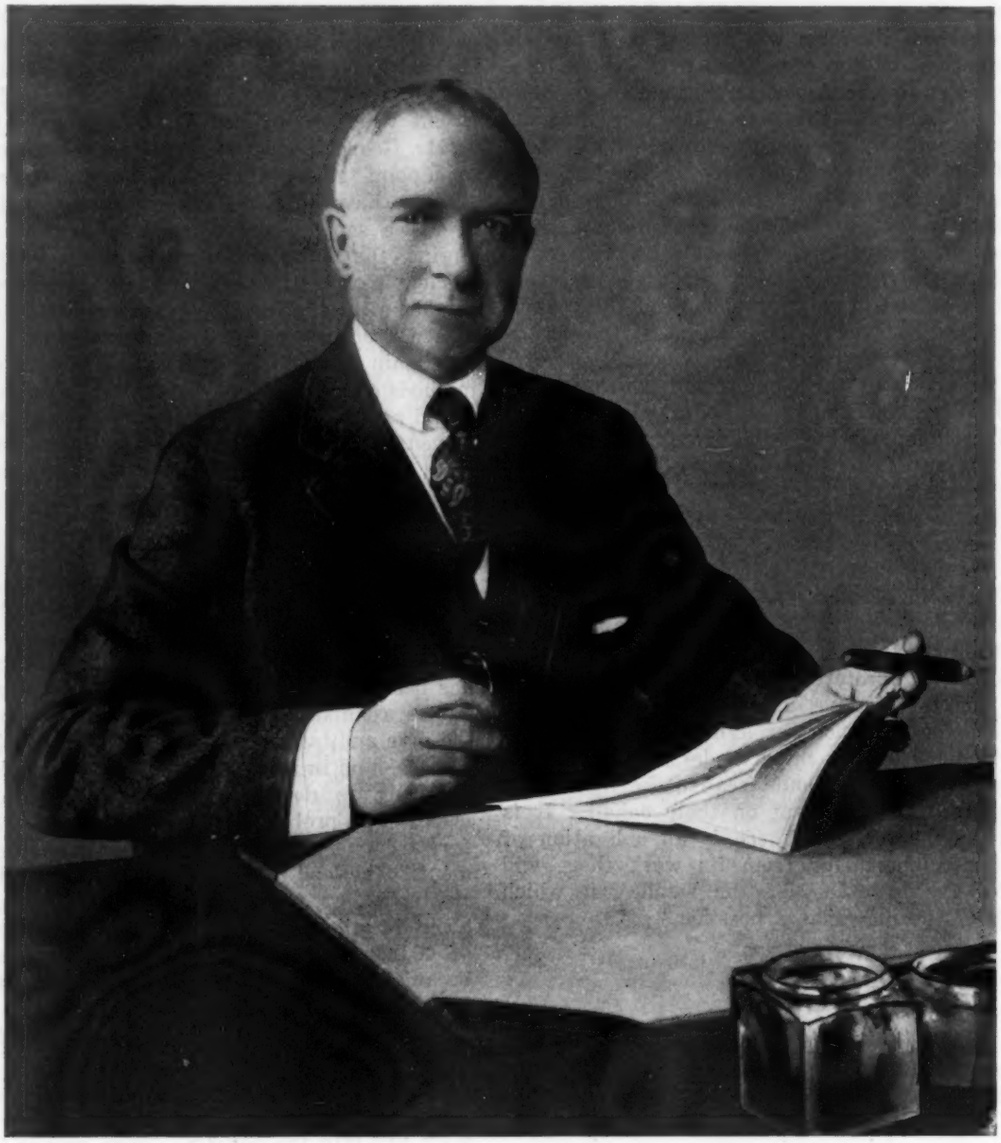
In analyzing a concrete case Mr. George makes out a small but material gain by using steam at intermediate pressure directly for the feed-water heating, rather than by passing it through the turbines of steam-driven auxiliaries, which produce only a certain fixed amount of exhaust steam, the amount depending on the extent of the service. So far so good; but the uncertain factor in the matter is the possible effect of the necessary amount of bleeding on the economy of the lower stages of the turbine. The whole amount of fuel saving figured out in the article before us is only from 1 to 2½ per cent, a quantity apt to be lost in the shuffle in determining actual turbine efficiencies. Here is the crux of the whole matter. Does bleeding to the necessary amount tend to lower the main turbine efficiency to an extent which would compensate the gain in operating as Mr. George suggests? From a purely thermodynamic standpoint steam applied to heating purposes would seem to have advantage in efficiency due to utilization over the same steam worked in any kind of a heat engine, the boiler and furnace being by far the most efficient part of the train of energy transformation. It would be interesting to see extensive comparative data drawn from experiments on the effect of bleeding on the main turbine efficiency and also on alternative methods of heating feed water. We think most engineers would agree, however, that on the whole the electrically driven auxiliaries under average conditions of service have at present fuel costs a material advantage.

## A Record Regulator Installation

IN THE control of alternating stations the induction regulator has long been on a small scale an extremely useful standby. For larger work synchronous apparatus has been freely used, but there are occasions when the simple regulator affords cheaply and conveniently all the give and take necessary to maintain voltages. Such a case found in the practice of the Philadelphia Electric Company is described by Raymond Bailey in this issue. The problem to be solved was a fairly straightforward one, requiring, however, rather drastic treatment. The load of the company is handled by two generating plants, the Schuylkill plant and that at Chester, about 14 miles (22.5 km.) apart and connected by a pair of 66,000-volt tie lines. To meet the growing load it became necessary to increase the kva. rating of these lines and to make the two generating stations pull together as efficiently as possible by keeping their bus voltages to about the same normal figure.

To meet the requirements two 1,750-kva. 9 per cent polyphase regulators equipped for outdoor installation were put into the service. They, rather than synchronous boosters, were chosen, because of their being cheaper and of more rugged construction while accomplishing the same result. The conditions on the lines necessary to voltage control were worked out on the customary vector diagrams and the regulators were planned accordingly.

To load the lines in any required manner it was necessary to know the phase relations of the regulator voltages with respect to each other and the lines, and this was accomplished by a special phase indicator connected to each regulator and so installed as to be in full view of the station operator standing at the regulator control panel. In the design of the regulators particular care was taken to secure mechanical immunity against the possible effect of short circuits, a serious matter when capacities such as those involved are considered. Operating experience with this installation shows the complete correlation between theory and practice that is to be expected and that it is possible by this means to obtain any desired loading conditions on the high-voltage tie lines while at the same time maintaining equal the bus voltages at the two distant generating stations.



## Calvert Townley

*who as president of the A. I. E. E. and chairman of the organizing conference of engineering societies ushered into being The Federated American Engineering Societies, is a resourceful engineer-executive, for many years identified with large engineering projects*

BEGINNING with the Brush Electric Light Company on the construction force of the Cincinnati (Ohio) lighting plant in 1887, Calvert Townley has been associated with many large commercial and engineering developments in the last thirty-three years. Since October, 1887, with the exception of six years, he has been associated with the Westinghouse Electric & Manufacturing Company in combined engineering, commercial and executive capacities. His first connection with that company was as erecting engineer. Later he was placed in charge of the design of the Gaulard & Gibbs alternating-current lighting system. From 1888 to 1895 he was assigned to commercial and executive work as assistant to Messrs. Pease, Byllesby and Bannister, vice-presidents of the company. As manager of the Boston office of the Westinghouse company from 1895 to 1900, Mr. Townley was closely associated with large engineering work throughout New England. From 1901 to 1904 as general agent, with headquarters in New York, he was in charge of Westinghouse relations with the large transportation interests of New York City.

In December, 1904, Mr. Townley was appointed fourth vice-president of the New York, New Haven & Hartford Railroad and was placed in executive charge of the electrical work of the system. Under his direction the largest and most important electrification of that road, from Woodhaven to Stamford, was completed. In the fall of 1905 he became first vice-president of the Consolidated Railway (later the Connecticut Company) and consulting engineer for the New Haven railroad on electrical work. These relations were continued until 1911, when he returned to the Westinghouse company as assistant to the president, the position he now holds. In this capacity Mr. Townley has been given responsible charge of the company's outside interests and of its subsidiaries. In 1913 in the interests of his company he toured Europe and in 1914-15 South America. During the war he was engaged in the building of the Essington factories and the new town of South Philadelphia. In addition to his other duties, Mr. Townley has devoted much time to affairs of the Institute and of the Engineering Council. His appointment as chairman of the recent Washington conference of engineering societies, when in a masterly fashion he ushered into being The Federated American Engineering Societies, is a just recognition of the service he has rendered. His exceptional ability, resourcefulness and clear thinking have won great admiration and have brought to him many honors. Mr. Townley was born at Cincinnati, Ohio, Oct. 18, 1864, and was graduated from Yale with the degree of Ph.B. in 1886, and M.E. in 1888.

# Huge Induction Regulator Installation

## In Order to Work Transmission Lines at Maximum Load the Philadelphia Electric Company Installs, Out of Doors, Two 1,750-Kva., Three-Phase Regulators—Chart Shows How Transmission Line Characteristics Were Determined

By RAYMOND BAILEY
*Engineering Department Philadelphia Electric Company*

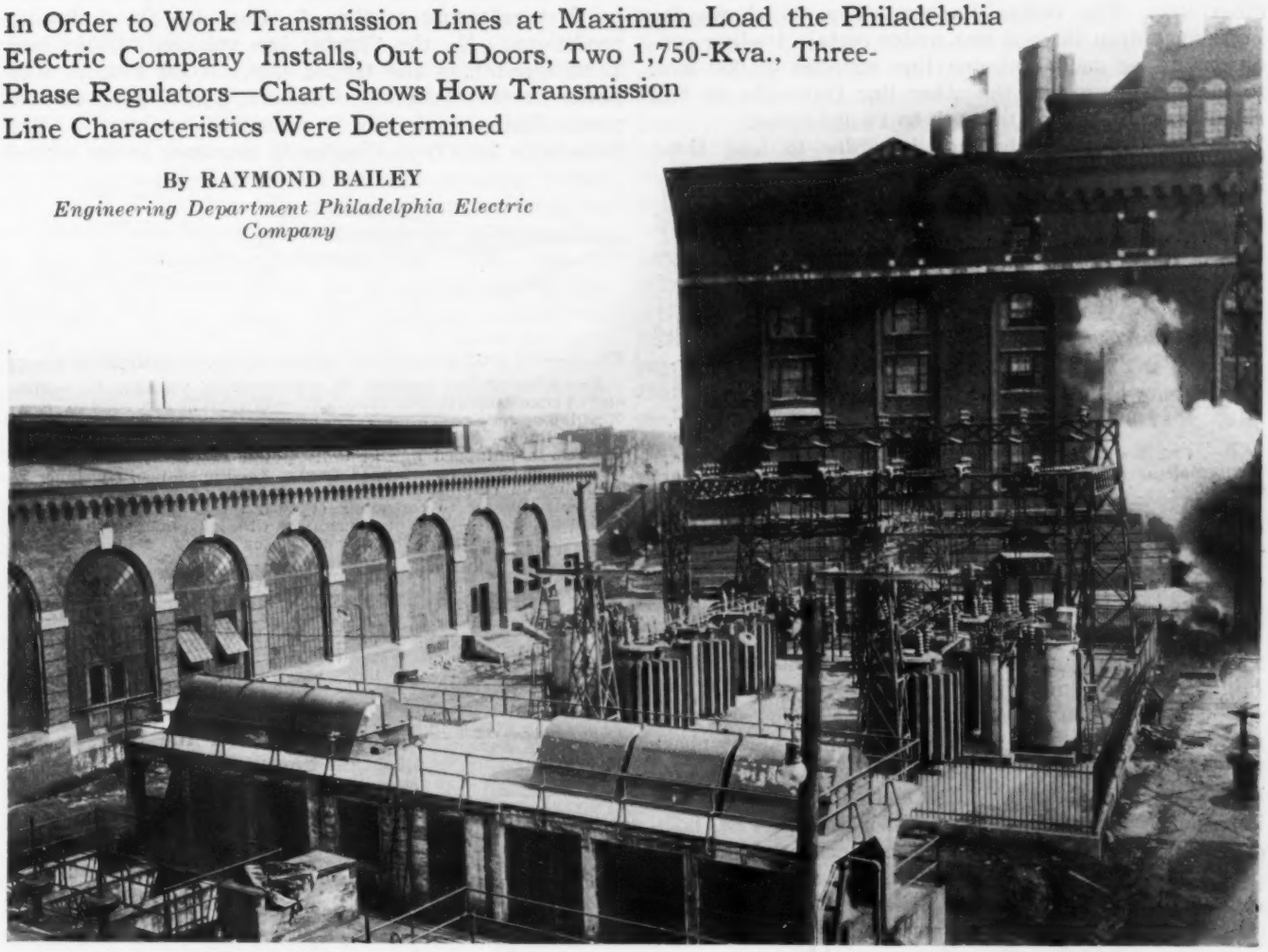


FIG. 1—66,000-VOLT OUTDOOR SUBSTATION IN WHICH TWO 1,750-KVA. REGULATORS ARE INSTALLED AT PHILADELPHIA

BY FAR the largest induction regulators ever built have been installed by the Philadelphia Electric Company in order to permit the operation of the 66,000-volt transmission lines from the Chester generating plant at maximum load under all conditions. The regulators, rated at 1,750 kva., are of rugged construction and are installed in the outdoor substation at the Philadelphia end of the lines. A chart has been worked out for the purpose of giving the proper regulator setting for different conditions of load. This is described in detail to show how the maximum loading of the lines is effected.

Fig. 2 is a single-line diagram showing the tie lines in which the regulators are connected and layouts of the outdoor substations connected thereto. The Schuylkill and Chester generating stations, in Philadelphia and Chester respectively, are connected by these two lines and are about 14 miles (23 km.) apart. The generating-station bus voltage—13,600—is stepped up in the outdoor substation for transmission at 66,000 volts, three-phase, 60 cycles, over lines of approximately 20,000 kva. rating each.

In order to supply the rapidly increasing demand for power in the Philadelphia district it was found advisable to make use of available generating capacity in Chester, which necessitated loading the two 66,000-volt tie lines to the maximum. The rate at which the power demand throughout the system of the Philadelphia Electric Company has grown is indicated by Fig. 3, which shows the yearly peaks in kilowatts since 1904.

It was decided that it would be necessary to increase the kva. rating of the two tie lines and to install voltage-regulating equipment so that the generating-station bus voltages would not differ greatly even when the lines were carrying full rated kva. at system power factor (approximately 85 per cent).

No trouble was experienced in increasing the rating of each 66,000-volt line from 15,000 kva. to 20,000 kva., as there was sufficient copper in each line to carry the increased current. The 13,200-volt to 66,000-volt transformer banks were rated at 15,000 kva., with a temperature rise of 40 deg. C., but are good for 55 deg. C. rise and 10 per cent overvoltage, at which rating they have the desired capacity. The capacity of the 13,600-volt cables from the generating stations to the outdoor substations was increased by pulling in an additional 1,000,000-circ.mil cable for each phase.

The matter of voltage regulation was not so quickly disposed of, owing mainly to the fact that, as these lines were to act as part of the additional generating capacity, it was decided to connect no equipment to them except that of the greatest reliability and sturdiness of construction.

The power demands of the consumers' substations tapped to the 66,000-volt lines (refer to Fig. 2) are such that one line is usually supplying from 10,000

kva. to 15,000 kva. more to these consumers than the other line. The vector diagram (Fig. 4) shows the impedance drop in each line under certain loading conditions to be such that one line supplies 15,000 kva. to the consumers and the other line transmits its full rated kva. all the way through to Philadelphia.

Fig. 4 shows clearly that in order to load these

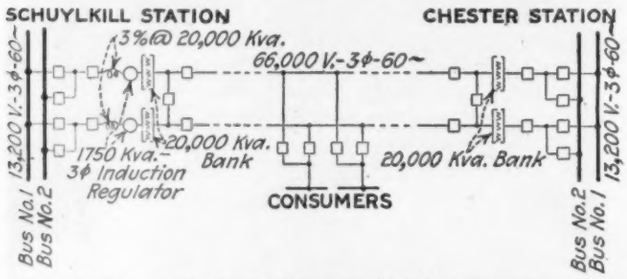



FIG. 2—LAYOUT OF THE TWO 66,000-VOLT LINES
All instrument transformers, disconnecting switches, etc., are omitted.

lines to the best advantage it is necessary to use a voltage-regulating device which will permit a variation of the phase relations of its voltage and the line voltage. $E_b$ and $E_e$ are the regulator voltages referred to. Both the synchronous booster (equipped with a frame-shifting device) and the polyphase induction regulator fulfill the requirements.

The synchronous booster, equipped with a frame-shifting device, is more flexible than the polyphase induction regulator in that its voltage may be varied both in magnitude and phase relation. The polyphase induction regulator was selected for this service, however, because it is superior to the synchronous booster in so far as simplicity, ruggedness and ability to resist short-circuit stresses are concerned, and on account of its adaptability to outdoor installation and its lower cost as compared with the synchronous booster.

A detailed analysis of the induction regulator proposition was made, using a circle diagram as shown in Fig. 5 in order to determine just what percentage of "buck" or "boost" would best meet the operating conditions. This circle diagram is arranged with scales to read total kva., kw., reactive kva., power factor, total amperes, reactive amperes and kw. line loss of the untapped line for certain assumed loading conditions of the line that is carrying the consumers' substations. In order to make sure that the regulators selected for these lines would take care of the worst conditions possible, it was assumed in the analysis that one line carried all of the load tapped off along the line.

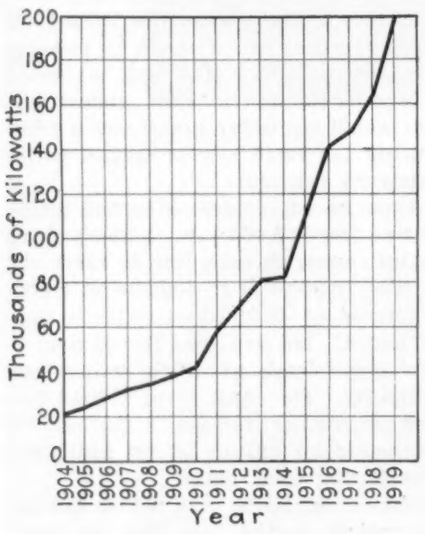



FIG. 3—YEARLY PEAKS OF THE PHILADELPHIA SYSTEM

The circle diagram may be more readily understood by first referring to Fig. 4. Consider the following conditions: $E_c$, the Chester bus voltage, 14,000; load from Chester to the tapped line, 20,000 kva. at 0.85 power factor; load to consumers, 15,000 kva. at 0.90 power factor (referred to consumers' voltage). The impedance drop from Chester to consumer in the tapped

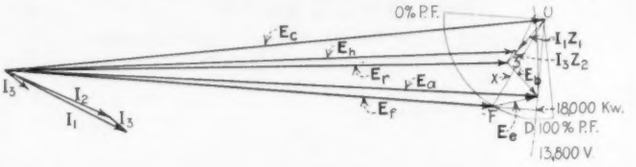
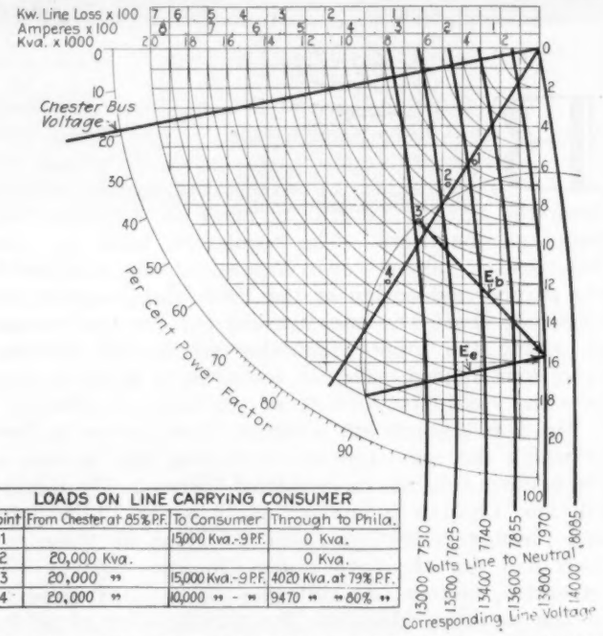



FIG. 4—VOLTAGE RELATIONS ON THE TWO TRANSMISSION LINES
$E_c$—Chester bus voltage. $E_h$—Consumers' voltage. $E_r$—Voltage at regulator (tapped line). $E_a$—Schuylkill bus voltage. $F_b$—Regulator voltage (tapped line). $F_e$—Regulator voltage (untapped line). $E_f$—Voltage at regulator (untapped line). $I_a$—Current in untapped line at unity power factor. $Z_1$—Impedance, Chester to consumer (tapped line). $Z_2$—Impedance, consumer to Philadelphia (tapped line). $Z_3$—Impedance (untapped line). $I_1$—Current, Chester to consumer (tapped line). $I_2$—Current taken by consumer. $I_3$—Current, consumer to Philadelphia (tapped line). $X$—Drop in untapped line for regulator position shown.

line is $IZ_1$; the impedance drop from consumer to Philadelphia is $IZ_2$. If Schuylkill station is carrying 13,800 volts at the bus, the regulator in this line will be placed in such a position that its voltage will be represented by the vector $E_b$. If the regulator in the second line is placed in a position corresponding to the vector $E_c$ and the governors of the turbines are adjusted so as to maintain the phase relation shown on the diagram for the generating-station bus voltages, then the current through this line will be of such a magnitude and phase relation as to give an impedance drop $X$.

The scales given on the circle diagram are based on




| LOADS ON LINE CARRYING CONSUMER | | | |
|---|---|---|---|
| Point | From Chester at 85% P.F. | To Consumer | Through to Phila. |
| 1 | | 15000 Kva.-9 P.F. | 0 Kva. |
| 2 | 20,000 Kva. | | 0 Kva. |
| 3 | 20,000 " | 15,000 Kva.-9 P.F. | 4020 Kva. at 79% P.F. |
| 4 | 20,000 " | 10,000 " - " | 9470 " " 80% " |

FIG. 5 — CIRCLE DIAGRAM FROM WHICH THE PERFORMANCE CHARACTERISTICS OF THE TWO TRANSMISSION LINES WERE OBTAINED

the fact that the magnitude of the impedance drop in the untapped line can be used as the measure of the kva. transmitted over the line and that the phase relation between the impedance drop in the line and the generating-station bus voltage has a definite relation to the power factor of the line. Therefore a

scale that will read the length of the impedance drop vector in any position can be marked to read the total kva. transmitted over the untapped line. At unity power factor this vector—*i.e.*, the vector of impedance drop over the untapped line—will read the kw. transmitted as well as the kva. The position of this line at unity power factor is given by $I_aZ_s$ (O-D) (Fig. 4). As the current lags from its position at unity power factor the impedance drop vector will move from its position at unity power factor through the same number of degrees. Therefore the projection of this line on *O-D* will be proportional to the projection of the line current on the line voltage and therefore proportional to the kw. transmitted over the line. A scale can now be placed on the line *O-D*, which will read kw. transmitted over the untapped line. At zero power factor the current will have swung through an angle of 90 deg. and the impedance drop through an equal angle to the position *O-G*. The arc *D-F-G* may now be drawn and divided so that it will read per cent power factor, 100 per cent being at the intersection of the arc and the line *O-D* and 0 per cent being at the intersection of the arc and the line *O-G*. By similar reasoning the power component of the current can be read from a scale on the line *O-D* and the projection of the impedance drop in it, and the reactive current and kva. by a scale on the axis *O-G* and the projection of the impedance drop on it.

The kw. line loss scale is placed above the scale giving the total current and is based upon the fact that the watt loss in the line is equal to a constant times the square of the line current ($3 \times I^2R$). The kw. line loss includes the resistance loss in the transformers but does not include the transformer core loss.

The circle diagram is made up much the same as Fig. 4, except that several of the vectors are omitted and the necessary scales with the subdivisions are added.

In order to use this diagram to determine what loading conditions can be obtained on the untapped line with a certain assumed load on the tapped line, it is necessary to compute the impedance drop in the tapped line for the loading conditions assumed. This impedance drop is laid off on the diagram and the point obtained to work from. In this case point 3 will be taken. Reference to the table (Fig. 5) will show that point 3 has been figured for 20,000 kva. at 0.85 per cent power factor out of the Chester station and 15,000 kva. into the consumers' substation at 0.90 power factor. The position of the regulator in the tapped line is now determined by the Schuylkill station-bus voltage. Assuming 13,800 volts, the regulator voltage will be $E_b$. With the end of this vector (regulator vector in tapped line) as a center a circle may be described and the conditions of loading which may be obtained in the untapped line are read at points on this circle. For example, consider the point where the circle intersects the 20,000-kva. arc. The position of the regulator in the untapped line is then $E_c$. The loading conditions are 20,000 kva., 17,900 kw., 0.89 power factor; reactive kva., 9,000; power component of current, 740 amp.; reactive component of current, 375 amp.; line loss, 700 kw. As another example assume that it is desired to have Chester supply kva. to the untapped line at system power factor, 0.85. Note the point at which the regulator circle intersects the 0.85 power-factor line. The regulator voltage will then meet this point. Reading the loading condition, we have 17,500 kva., 0.85 power factor, 14,900 kw.; reactive kva., 9,300; power component of current, 620 amp.; reactive component, 385 amp.; total current, 725 amp.; line loss, 530 kw.

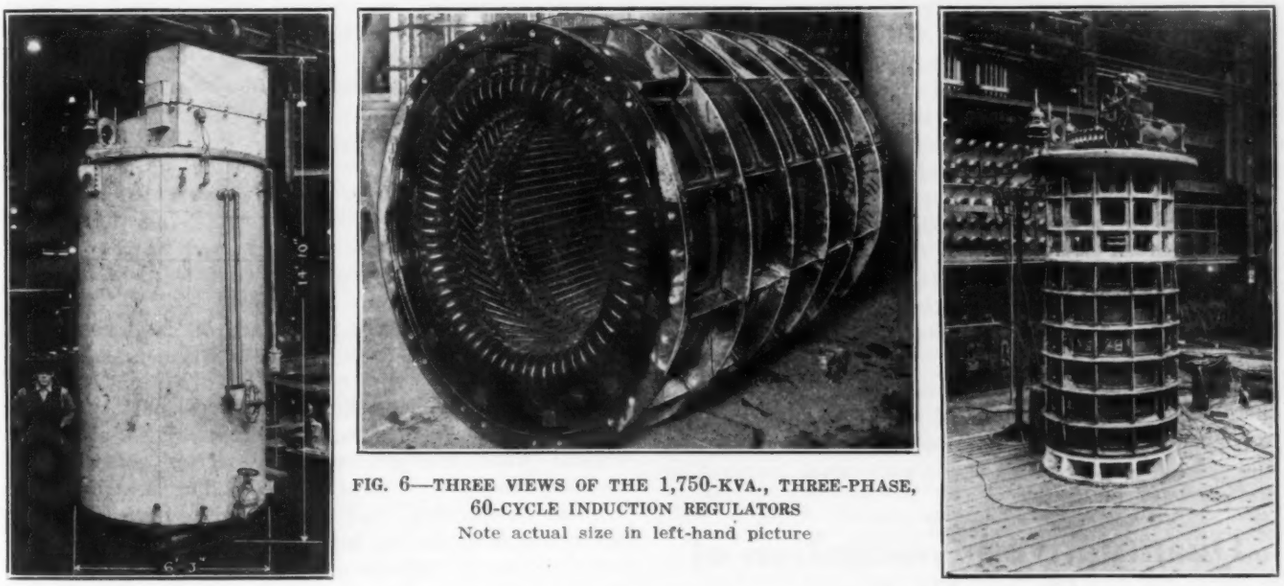


FIG. 6—THREE VIEWS OF THE 1,750-KVA., THREE-PHASE, 60-CYCLE INDUCTION REGULATORS
Note actual size in left-hand picture

It should be noted that all kva. and kw. values, power factor, etc., are given with respect to the Chester generating-station bus voltage. If the Chester station is assumed to be operating at any bus voltage other than 14,000, proportional correction must be made in the readings taken.

It was found that the desired loading conditions could be obtained by means of 1,750-kva., 9 per cent polyphase regulators, and two such regulators were accordingly purchased from the Westinghouse Electric & Manufacturing Company.

That the manufacturer's engineering organization has made every effort to build a regulator of the most rugged construction will be evident after referring to Fig. 6, which shows photographs of one of these regulators. Fig. 6 shows the complete regulator before

being placed in its boiler-plate tank. The complete regulator assembled in the tank is shown by Fig. 6. This photograph shows the pipe connection for the water-cooling coils and the breather. The weight of each regulator filled with oil is 56,000 lb. (25,000 kg.). The arrangement of the stator coils is shown by Fig. 6. Standard generator construction is used throughout, and the windings are braced to withstand short-circuit currents as great as fifteen times rated full-load current.

The photograph of Fig. 1 shows the Philadelphia 66,000-volt outdoor substation in which the regulators are installed. The cable connections to the regulators are arranged so that it is possible to disconnect them from the lines by loosening several clamped joints, swinging the cables over to other terminals and reclamping.

It was shown in another part of this paper that in order to load these lines as desired it is necessary to know the phase relations of the regulator voltages relative to each other and to the line voltages. This was taken care of by providing each regulator with a position indicator, which consists of a 360-deg. power-factor indicator remodeled for this service. Two of the potential coils of this instrument are connected to the line-potential transformers, and the third is connected through a potential transformer to the terminals of one of the secondary windings of the regulator. The position indicators, together with the instruments for the two transmission lines, are installed so as to be in full view of the station operator when standing in front of the panel on which the regulator operating motor control is placed.

Operating experience gained since the regulator installation has been completed shows that it is possible to obtain the desired loading conditions on these lines and at the same time maintain equal generating-station bus voltages.

# Quantitative Investigation of Piezo Emfs.

### High Emfs. Are Produced Mechanically by Axial and Torsional Stresses—A Reversible Process—Experiments Were Conducted with Rochelle Salts

THE Piezo electric effect is an electro-elastic property of certain crystals by means of which mechanical energy may be converted into electrical energy and vice versa. An interesting investigation of certain Rochelle salt crystals was reported by A. McL. Nicholson at a recent meeting of the American Institute of Electrical Engineers.

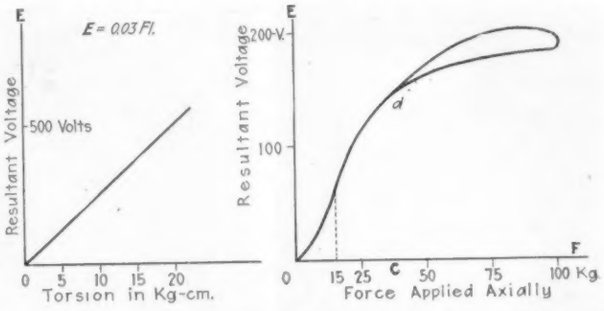
It was found that emfs. were developed at the ends of the crystals when either an axial or a torsional stress was produced and that conversely the application of emf. to the crystal produced mechanical movement. The quantitative results are shown in the figure.

Analysis of the direction of applied stresses to the sensitive regions described has shown that for the composite structure a twisting couple about the principal axis excites the greatest potentials between the crystal electrodes.

The electric charge measured by twisting the crystal is much greater than the charges produced by applying axial or diagonal forces, not only for very reduced torques and stresses but for magnitudes of stress approaching saturation in the case of the axial and diagonal forces. In the case of torsion there exists the advantage of the couple, since the force is applied at a given radius from the polar axis.

On plotting the relation between electric potential and various loads applied by axial compression to the composite crystal, the approximately quadratic curves shown in the figure are obtained. It has been found advantageous to apply permanent static compression and obtain thereby greatly increased effect. The value of the applied static pressure for maximum change in slope corresponds to an absolute force of approximately 15 kg. At this point in the curve a variation of applied axial force of 1 kg. will produce in a good crystal 8 volts. Beyond this point the curve becomes less steep. The static pressure may be applied permanently to the crystal without apparent fatigue.

A special microphone was applied to a crystal pole in various positions with respect to the crystallographic




VOLTAGES RESULTING FROM TORSIONAL AND AXIAL FORCES IN ROCHELLE SALT CRYSTALS

axis. The microphone, being in a local battery circuit operating a thermocouple, was actuated by the dilating crystal when the constant alternating potentials of various frequencies were applied. The measurements showed conclusively that the crystal twisted or moved the microphone button to the greatest degree when the axis of the microphone was attached tangentially to one of the crystal poles. The motions applied to the microphone were much smaller when they were diagonal or axial in character.

The relation between piezo-electric charge and torsion is linear (see the illustration) and is given by

$$E = KFL,$$

where $K = 0.03$ for several crystals tried,

$L =$ force in grams,

$E =$ potential in volts.

Since, with these composite crystals, a given force produces its chief piezo effect when it is applied in such a way as to twist the crystal about its principal axis, and, conversely, an applied electrical force produces the maximum mechanical response in the form of twisting motion, it is apparent that whether we are interested in producing electrical or mechanical results from the crystal the diaphragms should be so attached as to make maximum use of the torsional effect.

Applications of the piezo-electric effect in such crystals to the transmission and reception of sound were described and demonstrated.

Since the presentation of Mr. Nicholson's paper the suggestion has been made that sufficient piezo-mechanical stresses may be set up in the microporcelain of high tension insulators actually to loosen the crystals, and thus render the porcelain less capable of resisting moisture absorption.

# Federation of Engineering Societies

## Report of the Organizing Conference at Washington, D. C., Which Resulted in the Formation of The Federated American Engineering Societies—Its Prominent Objects and Plan of Organization

AT WASHINGTON, D. C., on Thursday and Friday of last week, at a conference of the national, local, state and regional engineering and allied technical societies, the foundation was laid for the most comprehensive organization of engineers in this or any other country. Under the title of The Federated American Engineering Societies there has been set up a form of association embracing all the engineering professions, with the definite object of establishing machinery whereby engineers as a group can render service in the public affairs of the city, the state and the nation whenever engineering experience and technical knowledge are involved and to consider and act upon matters common to the engineering and allied technical professions. Delegates from fifty-seven societies were present from all sections of the United States out of a scheduled representation of sixty-seven.

The form of the new organization, based upon membership of societies and affiliations instead of individuals, which has been under consideration for some time, was planned under the direction of Richard L. Humphrey as chairman of the joint conference committee of the four founder engineering societies and member of the American Society of Civil Engineers. In opening the first session on Thursday morning at the Cosmos Club, Mr. Humphrey reviewed the work of the joint conference committee and explained the activities of the Engineering Council, which has in a limited way during the past three years functioned along lines similar to those proposed for the more comprehensive organization. His remarks are abstracted on page 1360.

### The Preliminary Resolution

Formal presentation of the following resolution by Gardner S. Williams, member of the American Society of Civil Engineers, opened the debate on the plan of organization:

*Resolved*, That it is the sense of this conference that an organization be created to further the public welfare where technical knowledge and engineering experience are involved and to consider and act upon matters of common concern to the engineering and allied technical professions, and

*Resolved*, That it is the sense of this conference that the proper organization should be an organization of societies and affiliations and not of individuals.

Opposition to the principle of membership by societies instead of individuals came largely from members of the American Association of Engineers. That organization, which is made up of more than 18,000 individual members, has during the past five years had a rapid growth based upon its activities in welfare work of benefit to engineers in all professions. In accepting the invitation to send delegates to the Washington meeting this association contended that the organization of a national association of engineering organizations with representatives widely chosen by local affiliations and national organizations would duplicate the effort of the A. A. E. and add useless machinery. It was along these general lines that arguments pro and con were advanced. The debate, however, was brief, and when the resolution was put to a vote the seventeen representatives of the American Association of Engineers, on account of the alphabetical position of that body in the list of participating organizations, cast the affirmative votes. This action effectively dispelled any feeling of antagonism toward the new movement, and the resolution was unanimously carried by 119 votes from representatives of fifty-two of the fifty-seven societies present. With this point settled, the order of business of the first session was completed by the appointment of committees on program, credentials, constitution and by-laws, and resolutions.

### Constitution and By-Laws

The sessions on Friday morning and afternoon were largely devoted to a discussion of the form of constitution and by-laws drawn up by the committee. In the vote on the constitution, eighty-eight representatives of forty-nine societies voted in the affirmative, with representatives of eight societies reporting "not voting." Among the latter was the American Association of Engineers. William J. H. Strong, the chairman of the delegation, in reporting its vote made a statement in part as follows:

The American Association of Engineers has stood for co-operation. Our delegates came to this conference in good faith; we have acted there in good faith, and we wish to continue to act in the future with equally good faith for the welfare of the public and the engineers as a profession, as well as for the individual engineer.

The latter part of yesterday's resolution, upon which our delegates unanimously voted aye, specifically states that the new organization shall not receive individual members. If you will turn to page 1 of the first draft of the constitution, Article III, Section 3, you will note that it reads that the membership "shall consist of affiliations consisting of any one or of a combination of the following constituents," and paragraph 3 thereunder states "local engineers and members of allied technical professions and their associates." We regard that phraseology as capable of a construction contrary to the latter part of yesterday's basic resolution.

We would call your attention to the fact that while our vote of today will be a disappointment to you, yet we have in every way sought to co-operate with you, if not on one basis, then upon another. We sought in the first place to show you that the form of organization which you have planned is historically wrong and cannot be made to function properly, and we have recited valid historic precedent for this judgment. The structure also seems cumbersome and certainly the relations between the council and the board will have to be either altered or ignored. Such discrepancies, however, are usually present in new endeavors and under able management will no doubt ultimately be ironed out. We would also state that the constitution as presented is contrary to a well-accepted American principle, that "taxation without representation is tyranny," and therefore if for no other reason the delegates of the American Association of Engineers cannot ratify this constitution with the basis of representation therein outlined. Such representation under this constitution would work out for the American Association of Engineers about as follows: Under this constitution the American Association of Engineers would shortly be called upon for $32,000, and its voting representation would be on a basis of only one to sixteen. In other words, the dollar of dues paid by the small units of the federated societies would have sixteen times more voting power than the dollar paid by the American Association of Engineers. We stand unalterably on the principle of a dollar of vote for each dollar of dues.

Further, our association offered to you its own organization established, proved and in successful operation, subject to such modifications as would make it sufficiently comprehensive to carry on the work it is now successfully doing and to include the fields of activity which the new federation chiefly aims to cover, as evidenced in the resolution of June 3. This you declined.

We then, as is known to some of you, offered to divide

the field of co-operative engineering effort, we to take the welfare work pertaining to the individual engineer as an individual, and you to take the work outlined in the first part of the resolution of June 3. This you also have refused.

In accordance with the practice of our association in times past to make special appropriations of funds to attain special objects of interest to the engineering profession, we then offered a suggestion that you specially provide in your constitution the channel for such special appropriations, so that we might respond financially should you desire such support from us and we make the necessary appropriation. This also was rejected in the form in which we suggested it.

Up to the present the engineer has evidenced very little of the real co-operative spirit. We are teaching it in the American Association of Engineers, and while we at present recognize, as is evidenced by this conference, that two societies are necessary at the present time, it is our earnest hope that as time passes and the ability of engineers to co-operate successfully is developed ultimately there may be one large society covering all interests of engineers and all technical men, but while we await that ideal condition be assured that we shall in no point fail to co-operate with you within the limitations which we have outlined.

We again express our appreciation for the entertainment which you have so generously extended to us, and we particularly appreciate the words uttered by Mr. McGraw in his able address of June 3. Such words by him and others of the members of this conference have placed a burden of responsibility upon us to keep the faith and that we ring true to you and to ourselves, and it is therefore in the light of the above that I announce seventeen delegates of the American Association of Engineers present but not voting.

### MANAGEMENT THROUGH AMERICAN ENGINEERING COUNCIL

The constitution as adopted is presented in full below. It provides for three main classes of membership: (1) National engineering and allied technical organizations; (2) local, state or regional engineering or allied technical organizations other than local associations, sections, branches or chapters of national organizations, and (3) affiliations consisting of local sections of engineering associations, clubs and local engineers. Management of the organization is vested in a body to be known as the American Engineering Council and an executive board. The former, made up of representatives of the member societies, will be the name under which the work of the federation will be generally known and will co-ordinate the activities of the state councils and the local affiliations. It will be a large body made up on the basis of one representative for a membership of from 100 to 1,000 inclusive and one additional representative for each additional 1,000 members of each national, local, state or regional organization of affiliation.

The executive board will consist of thirty members of the council and be charged with conducting the business of the organization under the direction of the council. Six of the thirty members will be officers chosen by the council and twenty-four selected by the national societies, local, state or regional organizations or affiliations according to districts.

The financial needs of the organization will be derived from the member societies on the basis of $1.50 per year per member of the national societies represented on the council and $1 per year per member of local, state or regional organization or affiliation. On this basis a revenue of $75,000 per year is estimated at the start.

A noteworthy feature of the constitution is the article on publicity, which was incorporated largely at the suggestion of James H. McGraw, president of the McGraw-Hill Company and a delegate from the A. I. E. E., as a result of his address on the "Value of Publicity for the Engineer" and his exposition of the ways in which the technical and general press can serve the association and lay before the thousands of engineers included among their readers the program of work which the association will pursue.

The section of the by-laws dealing with publicity as referred to in Article X of the constitution is as follows:

**Chapter 4—Publicity**

SEC. 1. The privilege of attendance of all meetings of the American Engineering Council, of the executive board and committees, when not in executive session, shall be extended to any proper person, but this privilege does not extend the right to speak or vote. Any proper person shall have the right to inspect and make true copies of the record of all meetings of the council, executive board and committees.

SEC. 2. The committee on publicity and publications may employ a publicity secretary, whose duty under the direction of the executive board shall be to prepare and supply to the engineering, technical and general press news from the Federated American Engineering Societies and of the engineering world and to co-operate with the editors of engineering and technical publications in disseminating information in regard to this organization and its activities. The committee on publicity and publications may appoint a co-operating board of engineering editors to counsel or assist in any or all of its activities.

The following resolutions adopted by the conference indicate the activity which it will immediately pursue:

1. Urging the payment of adequate salaries for the teachers of engineering in our technical institutions in order that adequately trained young engineering talent may be made regularly available.
2. Advocating the immediate adoption of appropriate measures to give effect to the recommendations made to Congress by the commission, which recently reported upon a more adequate salary schedule for the engineering and other technical services of the federal government.
3. Indorsing the bill which has for some time been under consideration by Congress for the creation of a Department of Public Works.
4. Expressing the appreciation of the organization conference for the valuable work of the Engineering Council, especially its offers of assistance in making effective and operative the newly devised plan of organization, and expressing thanks to the Washington Society of Engineers and the Cosmos Club for their courtesy and assistance afforded during the sessions of the conference.

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# Harmony on Fundamentals, Not Details, the Object Sought

## Chairman Humphrey Sketches History of the Movement and Predicts Successful Outcome for the Conference

IN OPENING the conference Richard L. Humphrey, chairman of the joint conference committee, reviewed briefly the causes that had led to calling the delegates together to consider what he termed some of the most important questions that have ever confronted the engineering and allied technical professions in this country. The convention, he said, must decide whether there should be formed a comprehensive organization that could speak for these professions in public affairs where technical knowledge and engineering experience are involved, as well as on other matters that are also of common interest, or whether the respective societies should, as heretofore, pursue their separate ways and only occasionally co-operate in matters of common concern. The problem was of national as well as of local importance, and because of this importance any decision reached should reflect the judgment of all those represented.

This meeting marked the culmination of many years of efforts to bring about the formation of an all-inclusive organization, and these efforts had been crystallized during the last two years by the work of the joint conference committee, representing the Amer-

ican Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers. The first step toward such an organization had been taken June 27, 1917, when the representatives of the four societies named organized the Engineering Council "to provide for consideration of matters of common concern to engineers, as well as those of public welfare in which the profession is interested, in order that united action may be possible."

Subsequently the joint conference committee was organized by the four great societies, and in January last the governing boards of these societies, the American Society for Testing Materials and the trustees of the United Engineering Society unanimously requested the joint conference committee to call a conference of representatives of the national, local, state and regional engineering organizations of this country for the purpose of bringing into existence a comprehensive organization. In compliance with this request the joint conference committee issued an invitation to

CONSTITUTION OF

# The Federated American Engineering Societies

### Article I. Name

The name of this organization shall be the Federated American Engineering Societies.

### Article II. Object

Service to others is the expression of the highest motive to which men can respond, and duty to contribute to the public welfare demands the best efforts that men can put forth, therefore it shall be the object of this organization to further the interests of the public through the use of technical knowledge and engineering experience and to consider and act upon matters common to the engineering and allied technical professions.

### Article III. Membership

SEC. 1. SCOPE.—The membership shall consist of national, local, state and regional engineering and allied technical organizations and affiliations, classified as follows:

(1) National engineering and allied technical organizations.

(2) Local, state or regional engineering or allied technical organizations other than local associations, sections, branches or chapters of national organizations.

(3) Affiliations consisting of any one, or a combination, of the following constituents: (a) Local sections or associations of members of national organizations included under (1); (b) local engineering or allied technical societies or clubs, not of national scope; (c) local engineers and members of allied technical professions and their associates.

SEC. 2. QUALIFICATIONS.—The qualifications for membership shall be as provided in the bylaws.

SEC. 3. APPLICATION FOR MEMBERSHIP.—Application for membership shall be made in the form and manner prescribed in the bylaws.

SEC. 4. TERMINATION OF MEMBERSHIP.—The membership of any constituent organization may be terminated by it or by the council in the manner provided in the bylaws.

### Article IV. Management

AMERICAN ENGINEERING COUNCIL

SEC. 1.—The management of this organization shall be vested in a body to be known as the "American Engineering Council" and its executive board.

SEC. 2. FUNCTIONS.—The American Engineering Council shall consist of representatives of member societies selected as hereinafter provided. This council shall co-ordinate the activities of state councils and of local affiliations whenever these activities are of national or general importance or may affect the general interests of engineers.

SEC. 3. REPRESENTATION.—Each national, local, state or regional organization or affiliation shall be entitled to one representative on the council for a membership of from 100 to 1,000 inclusive, and one additional representative for every additional 1,000 members or major fraction thereof; provided that in the determination of the representation of local, state or regional organizations or affiliations no count shall be taken of any organization which is represented individually or through another local, state or regional organization or affiliation; and provided further than no organization shall have more than twenty representatives on the council.

SEC. 4. SELECTION OF REPRESENTATIVES.—Representatives on the council shall be selected as stipulated in the bylaws.

SEC. 5. MEETINGS.—The council shall hold an annual meeting. Other meetings may be called by the executive board and shall be called by it upon the written request of twenty-five representatives on the council.

SEC. 6. OFFICERS.—The elected officers of the council shall consist of a president, to hold office for two years and who shall be ineligible to re-election; four vice-presidents to hold office for two years, two to be elected every year, and a treasurer, to hold office for one year. These officers shall be elected by a letter ballot of the representatives on the council as provided in the bylaws. There shall be an executive officer who shall also be secretary appointed by and holding office during the pleasure of the executive board. He shall not be a member of the executive board but may be a representative on the council.

EXECUTIVE BOARD

SEC. 7. FUNCTIONS.—There shall be an executive board of thirty members of the council constituted as hereinafter provided and charged with conducting the business of the organization under the direction of the council.

SEC. 8. MEMBERSHIP.—The executive board shall consist of thirty members, of whom six shall be the officers elected by the council and twenty-four shall be elected, a part by the national societies and the remainder by the local, state and regional organizations and affiliations according to districts, as provided in the bylaws; provided that the number of representatives of the national societies shall bear as nearly as may be the same ratio to the number of representatives of local, state or regional organizations or affiliations as the representation of the national societies bears to the representation of the local, state or regional organizations or affiliations.

SEC. 9. ELECTORAL DISTRICTS.—For the purpose of facilitating the selection of the district members on the executive board, the council shall divide the country into districts as provided in the bylaws, based upon an equitable representation, having regard to both its membership and area.

SEC. 10. OFFICERS.—The president and secretary of the American Engineering Council shall be respectively the chairman and the secretary of the executive board. There shall be two vice-chairmen elected by the board from its members.

### Article V. Unexpired Terms

Vacancies in the offices of the president, the vice-presidents, the treasurer and in the executive board and among the representatives on the council shall be filled as soon as feasible by the agencies originally selecting the incumbents. Officers and delegates thus chosen shall serve for the unexpired terms.

### Article VI. Funds

SEC. 1.—Funds for the use of the organization shall be contributed as follows:

(a) Each national society represented on the American Engineering Council shall contribute annually $1.50 per member.

(b) Each local, state or regional organization or affiliation represented on the council shall contribute annually $1 per member. No portion of such funds shall be applied to the use of local affiliations or state councils.

SEC. 2.—The American Engineering Council may receive and administer gifts, bequests or other contributions for carrying out the purposes of the organization.

### Aticle VII. Local Affiliations

SEC. 1. OBJECT.—The American Engineering Council shall encourage the formation of local affiliations, to consider matters of local public welfare with which the engineering and allied technical professions are concerned, as well as other matters of common interest to these professions, in order that there may be united action and that suggestions and advice may be offered to the council.

SEC. 2. CONSTITUTION.—Each local affiliation desiring membership in this organization shall submit its constitution and bylaws and all subsequent amendments thereto to the executive board of the council for approval of such portion thereof as may affect its eligibility or its relation to the work of the council.

### Article VIII. State Councils

SEC. 1. OBJECT.—State councils, consisting of representatives of local affiliations within the state or otherwise representative of the majority of engineers and members of allied technical professions in the state, if members of this organization, shall consider state matters of public welfare with which the engineering and allied technical professions are concerned, as well as other matters of common interest to these professions, in order that there may be united action in state affairs.

SEC. 2. CONSTITUTION.—Each state council desiring membership in this organization shall submit its constitution and bylaws and all subsequent modifications thereto to the executive board of the council for approval of such portion thereof as may affect its eligibility or its relation to the work of the council.

### Article IX. Delimitation of Authority

Local organizations or affiliations, state organizations or councils and the American Engineering Council shall deal with local, state and national matters respectively, and they shall be autonomous with respect thereto. It shall, however, be the duty of the American Engineering Council to interest itself in the activities of local affiliations and state councils if such activities are of national scope or affect the general interest of the engineering and allied technical professions; provided that nothing herein stated shall be construed as preventing the discussion by any local affiliation or state council or by the American Engineering Council of any matters of interest to engineers and members of allied technical professions, or action by the said council on local or state matters where no local affiliation or state council exists.

### Article X. Publicity

This organization shall stand for the principle of publicity and open meetings under such regulations as may be provided for in the bylaws.

### Article XI. Amendments

SEC. 1.—An amendment to this constitution may be proposed by the executive board.

SEC. 2.—An amendment may be proposed in writing, by at least twenty-five representatives on the American Engineering Council; such amendment shall be considered first by the executive board, which may approve, disapprove or formulate a modified or alternative amendment, report of which action shall accompany the original proposal to this organization.

SEC. 3.—Any amendment proposed as provided in Sections 1 and 2 shall be considered at a meeting of the American Engineering Council and shall be submitted to its members at least ninety days in advance of such meeting. At this meeting, provided a majority of the representatives are present, the amendment may be rejected or ordered submitted to the members of the council for letter ballot within thirty days thereafter, with such modifications as may be adopted by a majority of those present. The amendment shall fail of adoption if one-third of the votes cast are in the negative.

110 engineering and allied technical organizations and societies. These represented an aggregated membership of more than 120,000, who were entitled to send 184 delegates to the organizing conference. The list included all societies, organizations or affiliations, not associations, sections, chapters or branches of national societies, whose chief object was the advancement of the knowledge and practice of engineering and the application of allied sciences and which were not organized for commercial purposes.

The conference, Mr. Humphrey said, was thoroughly representative. There were in attendance delegates representing over 60 per cent of the organizations invited. These delegates, over 70 per cent of those who could attend under the conditions of the call, represented organizations having an aggregate membership of over 100,000, or 83 per cent of the membership of all the organizations and societies invited. This splendid response was evidence that the organizations represented looked with favor on the fundamental principles involved.

"We are met," Mr. Humphrey continued, "not to discuss details but to use our best endeavors to reach a harmonious agreement as to fundamental principles. This occasion, to be properly utilized, must deal with the fundamental principles involved and leave the working out of the details of whatever plan that may be agreed upon to the governing board of the new organization. I would suggest that this problem be approached with an open mind and that the discussion be on a broad, unselfish plane, having one object, namely, the good of the engineering and allied technical professions."

### WHAT ENGINEERING IS

Engineering, Mr. Humphrey said, is defined "as the art of organizing and directing men and of controlling the forces and materials of nature for the benefit of the human race." The growth and development of this country had been largely a matter of engineering. The European war, because of the brilliant work of the engineer, brought the universal recognition of his importance in its successful prosecution; it awakened the public to a keener realization of the service of the engineer and awakened in the engineer a desire for greater service to the public—a desire to do his part in the successful administration of the affairs of the nation. The engineer had, therefore, changed his viewpoint from the somewhat narrow one of following his profession exclusively to the broader one of unselfish devotion to the common cause.

"It is not to be expected," the chairman went on, "that a conference of this character, composed of delegates representing organizations and societies of widely different activities, could be brought together without the expression of a very considerable difference of opinion as to the best means of accomplishing the object sought. I believe that the keynote of this conference could be properly expressed by the word "service." We desire first to serve the country, and, second, to serve the societies and organizations of which we are the representatives. One cannot contemplate service, which means giving, not receiving, with any feeling that it is actuated by selfish motives, but rather is it the giving of our best.

"It is one of the outstanding characteristics of the engineer that he gets results. Let us, therefore, determine that this gathering, unparalleled in this country, shall not adjourn without having taken a forward step in the formulation of a plan which will culminate in some form of comprehensive organization that will represent the solidarity of these professions. If each one of us will keep this object firmly before him we shall attain the end desired."

## Four Possible Courses of Action Outlined

### Dr. Newell Favors, Among These, a Co-operative Arrangement Between the Technical Societies and the A. A. E.

DR. F. H. NEWELL, professor of civil engineering at the University of Illinois and past-president of the American Association of Engineers, representing the viewpoint of the latter body, declared that in the undertaking there was an attempt to repeat the experiment tried by the thirteen original states of the Union when they endeavored to form a confederation. "Experience has shown the weakness of this form of organization," Dr. Newell said. "Many of the men who have been studying the question of the effectiveness of an all inclusive or super-engineering association have reached the conclusion that in this matter we must ultimately follow the experience of the United States and form a new body politic, one which, while recognizing the separate existence of each and every other association, yet has the power of self-determination and is not dependent for its life and functions upon the action of any other association or group."

The speaker asked if it was necessary to construct a plan for another organization when the A. A. E. was already functioning along the lines contemplated. He specified four possible courses of action: (1) the ignoring of the existence of the A. A. E. by the other national societies; (2) a new organization as recommended in the report of the joint conference committee, but with the understanding that in its operations an attempt should be made to become acquainted with the activities of the A. A. E. and to co-operate rather than compete; (3) enlarging the functions of the engineering council, making it representative of those societies which confine their activities mainly to technical matters, and letting it be generally regarded as the spokesman of these societies on such matters, in the same way that the A. A. E. is the spokesman on lines of social, economic or political questions; (4) a co-operative arrangement between the technical societies and the A. A. E. individually in building the latter up as a broad, all-inclusive society, leaving the technical societies free to devote all of their funds to the kind of work in which they have been so successful in the past.

Of these plans the latter, Dr. Newell declared, is the one which is most nearly ideal, and which in the opinion of many engineers will ultimately prevail, even though at present the representatives of the older societies are unconvinced. The other plans, if tried out, he said, will ultimately be modified as the A. A. E. continues to grow in size and effectiveness. Opposition will undoubtedly strengthen it; thus the friends of the A. A. E., while deploring such differences of opinion among engineers, are not seriously disturbed at the possibility of competition; for it is, after all, the most energizing of all motives.

# Publicity for Engineers

## James H. McGraw Emphasizes the Great Part of the General and Especially the Technical Press in the New Movement

DECLARING that engineers are glad to have publicity but don't like to talk about themselves, James H. McGraw, president of McGraw-Hill Company, New York, publishers of the eleven McGraw-Hill engineering publications, deprecated this state of mind. One of the most constructive things the proposed organization could do, he held, would be to visualize the opportunities for publicity for the engineer and perfect some method of obtaining this publicity. As an individual, except under very specialized conditions, the engineer may not advertise. Because he has held himself professionally aloof he has had too little credit for the kind of thinking he does and his place at the world's council table is not recognized as it should be.

The great contribution of the engineer to modern life, Mr. McGraw said, is not mere technical knowledge and specialized information, but an all-around consideration of the problem presented from the point of view of service. That is what the engineer has to advertise, but to do it he must become a better business man, he must shuffle off some of the apparent narrowness that goes with a specialized kind of thinking, and his group must give expression to the idea that he is the man who makes our present life possible. In other words, the engineer must be human as well as an engineer.

There are four or five great mediums for publicity for engineers—the newspapers, the general magazines and weeklies, the technical and industrial press, papers before associations and societies distributed to specialized lists, and the public platform. A committee which could do much constructive work might be organized as a result of the proposed federation to analyze and develop opportunities for publicity in all these fields.

When it comes to publicity in general magazines of wide circulation the best way to get publicity is to bring in the point of view of men who make their living by appealing to the public. What the general magazine man wants is not an engineer's story of the development so much as an interpretation of the public conditions of that engineering development written from the point of view of the particular magazine or weekly.

The public platform offers another opportunity for publicity which in general is by no means capitalized by the engineer for reasons already given. Yet in hundreds of towns every week the engineer's place in the economic life of the community and his natural place in the development of local enterprises can find an audience before chambers of commerce, merchants' associations and other similar business organizations.

### RELATION OF TECHNICAL PRESS TO SOCIETIES

Alluding to the twofold purpose of the technical press, as a medium of publicity and as an interpreter of engineers to other groups and other industries, Mr. McGraw said that the technical press and the engineering societies are natural partners. The engineering press is a powerful and important factor without which this proposed organization would be badly crippled, if indeed it would be possible at all. A mutual recognition and support between the engineering societies and the engineering press is therefore necessary. The technical and ngineering press has been associated with the work of the societies from the very beginning. Several of the societies had their beginnings because of the enthusiastic support of the editors of the technical press, whose vision was added to that of other engineers to make the purpose of the societies evident to engineers at large.

The editorial policy of the technical journals today is the outgrowth of the splendid traditions of the past, and the editors today are equally responsive to the needs and to the purposes of the societies, with this exception, that both the journals and the societies have grown in complexity with the development of industry, and whereas in the early days of both the societies and the journals it was possible for a comparatively small group of men to know pretty much everything about the industry, today it takes large groups of men to keep in touch with the development of the industry, and there is a lack, not of desire to co-operate on either side, but of co-ordination of effort, which is at times responsible for the misunderstandings of purpose.

The world-wide sweep of the technical press in reporting openings and news of the industry is sometimes overlooked by the men who themselves are furnishing a great part of the news. In hundreds of offices technical journals are circulated not only to the engineers, but to the men who depend for their profit upon the work of the engineers, and on many a president's desk on Monday morning are laid the clippings from some engineering journal pointing to a new engineering department, or a new development in the industry or the art, or a new development in applied engineering in the industry on which his business depends. Scores of our leaders of industry have come to rely, moreover, on certain journals for certain classes of specialized information, and the news brought by the technical journal helps to make policies in business.

This great organ of education for the advancement of engineering is behind the engineering societies and their developments and should be put to even more definite purpose by complete understanding and co-operation with the engineering societies.

The technical press today, Mr. McGraw continued, is a part of the industry it serves. The editors are trained men with an intimate knowledge of engineering and engineering accomplishment and a point of view on the opportunities for engineering that is made possible because of their very calling. There is an apparent policy on the part of some of the society publications to look upon the publication work of the society as in the nature of a "scoop" to be held only for publication in the society journals. If engineering is to have publicity, certainly that publicity will never be gained if the greatest organ of the publicity, the technical press, is put in competition for news with the publications of the societies. There is certainly a place for the society publications. Societies need publications to transmit the business news of the society organizations and the papers and discussions which help to form the literature of the science or art of that society. But the speaker believed that it was an economic waste of white paper, to say nothing of brain power, so to misunderstand the function of the technical and engineering press as to duplicate that function and to assume that the organ of the society should parallel and take the place of independent technical journalism. There is no room for competition between the society journals

and the technical press and there should be none. An independent technical press is recognized by the public as an interpreter of constructive thinking in an industry. The editors of technical publications are one of the greatest forces for publicity in the country.

## Nation's Bigness Makes Organization Imperative

### Philip N. Moore Says That Only by Such Means and with Accredited Spokesmen Can Any One Interest Reach the Public Ear

SPEAKING for the Engineering Council, of which he has been a member from its start, Philip N. Moore, past president of the American Institute of Mining Engineers, paid tribute to its noteworthy accomplishments while declaring that "if another body can be formed which shall have stronger support, a greater clientage, more widespread loyalty, the Engineering Council stands ready to give place to it." The point which should be stressed, he said, is that unless the meeting could gather to it a larger representation of the local and State engineering societies and kindred societies, and unless these societies shall become active as well as nominal in their membership, nothing will be gained by changing a name or attempting a substitution for an existing organization which has found its place. Further, if the societies which become represented do not as such take an active part in the work for which the proposed council is designed, and if, still more important, the members of those societies do not realize that membership brings obligations, and that the only remedy for coterie control is widespread activity, these efforts will have been in vain.

"Our nation has grown so large," Mr. Moore continued, "that with difficulty can any one man or set of men impress public sentiment with needs and ideals to a result of action. Originally, an impression desired could be activated through local aid. Fortunately for us, valued in terms of long time, local political force is lessened and the national motive has grown until it dominates. Only by organization expressed through accredited spokesmen can any one interest reach the public ear and wield political influence. This is not an unmixed good—quite the contrary—but it is a condition which limits the activities of all organizations, and apparently until mankind shall change its ways of thought, it is a condition which will endure and must be reckoned with."

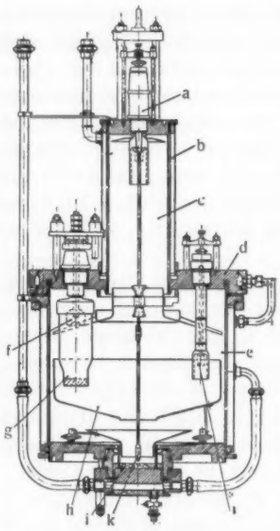
## Addresses by Prominent Delegates and Others

INTERSPERSED throughout the session of the two days were addresses on general topics by prominent engineers and executives who emphasized the influence and functions of the engineer in public affairs. The following were among the speakers, in addition to those whose addresses have been abstracted on the preceding pages: Arthur P. Davis, president American Society of Civil Engineers and director United States Reclamation Service, Washington, D. C.; Leroy K. Sherman, president American Association of Engineers and president United States Housing Corporation, Washington, D. C.; Thomas H. MacDonald, chief Bureau of Roads and Rural Engineering, Washington, D. C.; William D. Uhler, chief engineer Pennsylvania State Highway Department, Harrisburg, Pa.; Homer L. Ferguson, past-president United States Chamber of Commerce and president Newport News Shipbuilding Company, Newport News, Va.; George Otis Smith, director United States Reclamation Service, Washington, D. C.; Samuel M. Vauclain, president Baldwin Locomotive Works, Philadelphia, Pa.; Robert S. Woodward, president Carnegie Institute, Washington, D. C.; and James R. Angell, chairman National Research Council, Washington, D. C.

Great credit is due to Calvert Townley, president of the A. I. E. E., who served as chairman of the conference, which he conducted under the Roberts rules of orders with marked ability and fairness.

## Mercury Arc Rectifiers for Large Outputs

SOME of the problems in the manufacture of rectifiers for large outputs arise from the difficulty of constructing large metallic chambers sufficiently gas-tight to enable a vacuum of 0.02 mm. of mercury to be maintained. The insulated terminals for the conductors carrying the current should be perfectly gas-tight. Some means must also be provided for preventing short circuits between the anodes, for as the output to be converted increases the changes of short circuits between anodes also increase. It is said that it is possible to prevent short circuits by carefully choosing the position of the electrodes in the apparatus and by compelling the arc to follow a predetermined path with the aid of shields and suitable guides.




DIAGRAMMATIC REPRESENTATION OF A MERCURY-ARC RECTIFIER FOR LARGE OUTPUTS

*a* Ignition solenoid.
*b* Water-jacket.
*c* Condensing cylinder.
*d* Cover carrying anodes.
*e* Arc chamber.
*f* Anode.
*g* Anode cover.
*h* Arc collector.
*i* Cathode.
*k* Ignition anode.
*l* Excitation anode.

One of these rectifiers manufactured by the Brown, Boveri Company is described as consisting of a circular chamber having a cylindrical extension at the top wholly built of steel plates. The base and the cover of the chamber are made of thick steel plates. The mercury cathode is contained in a recess in the base, while the cover is perforated to receive the six principal anodes and the two auxiliary anodes for the excitation of the rectifier. The cylindrical extension acts as a condensing chamber for the mercury vapor which arises from the cathode. The cover of the condensing cylinder carries a solenoid for controlling the ignition anode and a screw ring for lifting purposes. To prevent the discharges which may occur between the anodes and the parts of the chamber adjacent to them the arc and the anodes are surrounded by protecting tubes of insulating material.

A recent design of high-capacity rectifier is shown in the illustration. Further particulars may be found in the London *Electrician*, Jan. 2, 1920.

# Electric Drive for Station Auxiliaries

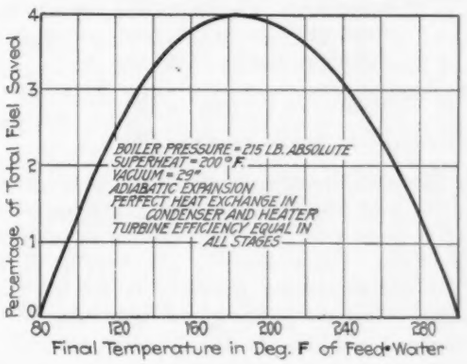
## Motors, with Steam Diverted from Intermediate Stage of Main Turbines for Feed-Water Heating, More Economical than Steam Auxiliaries

By E. E. GEORGE
*A. L. Drum & Company, Chicago*

IT IS the general custom in power plants to use enough steam-driven auxiliary apparatus to furnish exhaust steam for preheating the feed water and after this is done to use electric drive for any excess of auxiliaries. This discussion will show that diverting steam from an intermediate stage of the main turbine to heat the feed water and driving all the auxiliaries by electric motor is a more economical method. With electrically driven auxiliaries there is also an additional saving possible through varying the amount of diverted steam to the most economical value. Exhaust steam is the only thing that is required, and it may be taken from an intermediate stage of the turbine as well as from auxiliaries. There is no reason why it should not be reduced to a low pressure by the most efficient process; that is, in the large turbine, which will get the most work out of the steam while its pressure is diminishing. For the same exhaust pressure the quality and the heat content are about the same with the diverted steam as with the exhaust steam of auxiliaries. Moreover, bleeding a small part of the steam at a certain stage does not appreciably lower the efficiency of the later stages of the turbine.

Briefly, the reasoning is as follows: Every pound of steam taken from the main turbine at atmospheric pressure has done about 75 per cent more work than a pound of exhaust steam from the auxiliaries. The saving with electrically driven auxiliaries, however, is not 75 per cent, but is reduced to 60 per cent by electrical losses. A kilowatt-hour increase in energy requires only one-third as much steam for its generation in the main turbine as in the steam auxiliary. Therefore the net saving in steam is 0.60 divided by 3, or 0.20, times the steam used by the auxiliary. How this saving is derived is told in more detail in the following paragraph.

Small turbines in the sizes used in driving power-plant auxiliaries take from 35 lb. to 65 lb. (15.8 kg. to 29.4 kg.) of steam per kilowatt-hour, depending upon their size. Reciprocating auxiliaries taking from 70 lb. to 250 lb. (31.7 kg. to 158.7 kg.) per kilowatt-hour are seldom used in modern plants of medium or large capacity. The auxiliaries in such plants aggregate from 1½ per cent to 4 per cent of the total plant capacity. The efficiency of the main units is from 11 lb. to 20 lb. (4.9 kg. to 9 kg.) of steam per generated kilowatt-hour. The efficiency of the steam diverted at atmospheric pressure is from 20 lb. to 35 lb. (9 kg. to 15.8 kg.) per kilowatt-hour. In other words, 20 lb. to 35 lb. of steam diverted at atmospheric pressure has already done 1 kw.-hr. of work. Then 1/20 (0.05) to 1/35 (0.0286) is the number of kilowatt-hours generated per pound of diverted steam. The over-all losses of the generator, lines and motors used in electric drive are 9 per cent to 17 per cent. If the generator is considered as driven only by the diverted steam as it passes through the main turbine, then the efficiency of the total diverted steam is reduced 20/35 × (9 to 17) per cent, which equals 5 per cent to 10 per cent. Then 0.0475 to 0.0257 kw.-hr. is the net output per pound of diverted steam. But the steam auxiliaries deliver only 1/35 to 1/65, which equals 0.0286 kw.-hr. to 0.0154 kw.-hr. per pound. Therefore, taking the differences (0.0475 — 0.0286) to (0.0257 — 0.0154), the result is 0.0189 kw.-hr. to 0.0103 kw.-hr. saved for each pound of exhaust steam used. But in the main turbine 11 lb. to 20 lb. is used for each kilowatt-hour. Therefore 11 × 0.0189 to 20 × 0.0103, which equals about 0.21 in each case, is the number of pounds of steam saved for each pound used in the auxiliaries. The auxiliaries require 1.33 per cent to 4 per cent of the total power, and, if all are turbine-driven, 4 per cent to 12 per cent of the total steam. Therefore the total fuel saving is about 1 per cent to 2.5 per cent.




THEORETICAL FUEL SAVING BY PREHEATING FEED WATER TO TEMPERATURE OF PARTLY SPENT STEAM, NEGLECTING SAVING POSSIBLE BY ELECTRIC DRIVE

The other advantage of the electric auxiliaries is that the most economical amount of steam can be used for heating feed water. With the steam auxiliaries the amount of exhaust steam is fixed. There may, however, be another amount which is more economical and which it is possible to obtain when using diverted steam. This value may be determined by the following method:

Notation:

$H_l$ = the total heat above 32 deg. Fahr. (0 deg. C.) of the live steam (wet, dry or superheated) at boiler pressure.

$H_e$ = the total heat above 32 deg. Fahr. of the partly spent (or exhaust) steam (usually wet) at the pressure when diverted.

$H_f$ = the total heat above 32 deg. Fahr. of the feed water, after preheating.

$H_v$ = the total heat above 32 deg. Fahr. of the steam (usually wet) entering the condenser, at the condensed vacuum.

$H_c$ = the total heat above 32 deg. Fahr. of the condensate water, at the condenser temperature.

Equations:

$\frac{H_e - H_f}{H_f - H_c}$ = pounds of feed water heated per pound of exhaust steam.

$\frac{H_e - H_f}{H_b - H_c}$ = equivalent pounds of live steam at boiler pressure generated by available heat per pound of exhaust steam.

$\frac{H_e - H_v}{H_b - H_v}$ = equivalent pounds of live steam at boiler pressure taken from available mechanical energy per pound of exhaust steam.

$\frac{H_e - H_f}{H_b - H_c}$ must be greater than $\frac{H_e - H_v}{H_b - H_v}$ if any fuel is to be saved.

$\frac{H_f - H_c}{H_b - H_c} - \left(\frac{H_f - H_c}{H_e - H_f}\right)\left(\frac{H_e - H_v}{H_b - H_v}\right)$ = percentage of fuel saved.

Example: Steam at 215 lb. (17 kg. per sq.cm.) absolute, 200 deg. Fahr. (110 deg. C.) superheat, 29 in. (737 mm.) vacuum. Find the saving if feed water is heated 212 deg. Fahr. (100 deg. C.).

$$\frac{180 - 47}{1310 - 47} - \left(\frac{180 - 47}{1084 - 180}\right)\left(\frac{1084 - 890}{1310 - 890}\right) = 3.8 \text{ per cent.}$$

From the accompanying curve, which is plotted for the conditions of pressure, superheat, and vacuum listed above, it is seen that the fuel saving is maximum at 184 deg. Fahr. (84.4 deg. C.), where it is 4.0 per cent. The corresponding pressure is 8.2 lb. (0.57 kg. per sq.cm.) absolute. The final temperature of the feed water should always be as near as possible to the temperature corresponding to the steam pressure used, but with an open heater the pressure of the exhaust cannot be less than 14.7 lb. (1.03 kg. per sq.cm.) absolute, and the final temperature of the feed water cannot be over 212 deg. Fahr. 100 deg. C.). It should be noted that the percentage of the total fuel saved by preheating is independent of the source of the steam, but that the total fuel consumption, with or without preheating, is greater for steam-driven than for motor-driven auxiliaries because the total mechanical power is the same and the over-all efficiency is less.

The curve herewith, although plotted from the equation with only $H_e$ and $H_f$ variable (and dependent on each other), and with other conditions assumed, is representative of the variation of saving with feed-water temperature for all ordinary conditions. In finding the various values of total heat it should be noted that the steam is getting wetter as it expands to a lower pressure. The entropy is constant and a "Mollier diagram" or heat entropy chart, as furnished with most textbooks on thermodynamics, is the only quick way of finding the quality or total heat for any pressure. Condenser losses and other sources of error have been neglected, to simplify the reasoning, but the equation given is accurate enough for commercial purposes.

All the advantages of adjustable-speed, high starting torque, simplicity of maintenance, reasonable first cost, high maintained efficiency, durability, efficient speed, automatic control and easy application of safety devices are possessed by the direct-current motor generally to a greater extent than by the small turbine. In starting up the plant after a shut-down of the steam equipment it is advantageous to be able to run the feed pumps before steam is up. This is possible with motor-driven pumps using energy from another station or from a storage battery.

The idea of preheating feed water with partly spent steam from an intermediate stage of the main turbine is not new. Plants using the system have been described in American and British engineering periodicals, but it is not well known or widely used, perhaps because its mention has never been accompanied by a comparative over-all heat balance such as is described here.

# A Drive for High-Intensity Industrial Lighting

### Central Station Establishes Machine Shop in Heart of Retail District of Chicago to Prove Advantages of High-Intensity Industrial Lighting

BY O. R. HOGUE
Head Lighting Agent Commonwealth Edison Company, Chicago

IT IS not often that a central station sets out to make itself of any special and direct value to the electrical contractors and the builders. This claim may, however, be made by the Commonwealth Edison Company in connection with the demonstration of productive lighting intensities now being conducted in its downtown office building.

About 1,000 sq.ft. (93 sq.m.) of the company's retail-store space was set aside for this industrial lighting exhibit, consisting of two shops equipped with machine tools operated by regular mechanics. A typical system of illumination by drop cords and bare lamps was installed in one shop, while the other shop is equipped with type C lamps hung in modern industrial reflectors which give intensities of illumination of from 3 foot-candles to 114 foot-candles (32 lumens to 1,225 lumens per square meter).

In the intensively illuminated shop the lighting units are hung in groups of five reflectors in different positions and so wired and arranged that the effect of seven different combinations can be observed. Twenty-four foot-candles (258 lumens per square meter), which was considered to be the real productive intensity, can be obtained with any one of the group of reflectors. The effect of 6 foot-candles (64 lumens) is produced by reducing the number of units in one of the groups. Then 3 foot-candles (32 lumens) is obtained by raising the reflectors and leaving the lamps bare. This is accomplished by means of ropes and pulleys.

Other tests are provided to show the effect of glare, Mazda B and C-2 lamps are compared for color matching, the application of diffused and directional lighting is shown, and legibility tests are made by dropping letters past an open slot. At 1.5 foot-candles (15 lumens) the letters cannot be distinguished. The intensity of illumination is then gradually increased to 15 foot-candles (160 lumens), at which point the letters are perfectly plain.

It was impracticable to show more than a few representative types of reflectors in the shops proper but

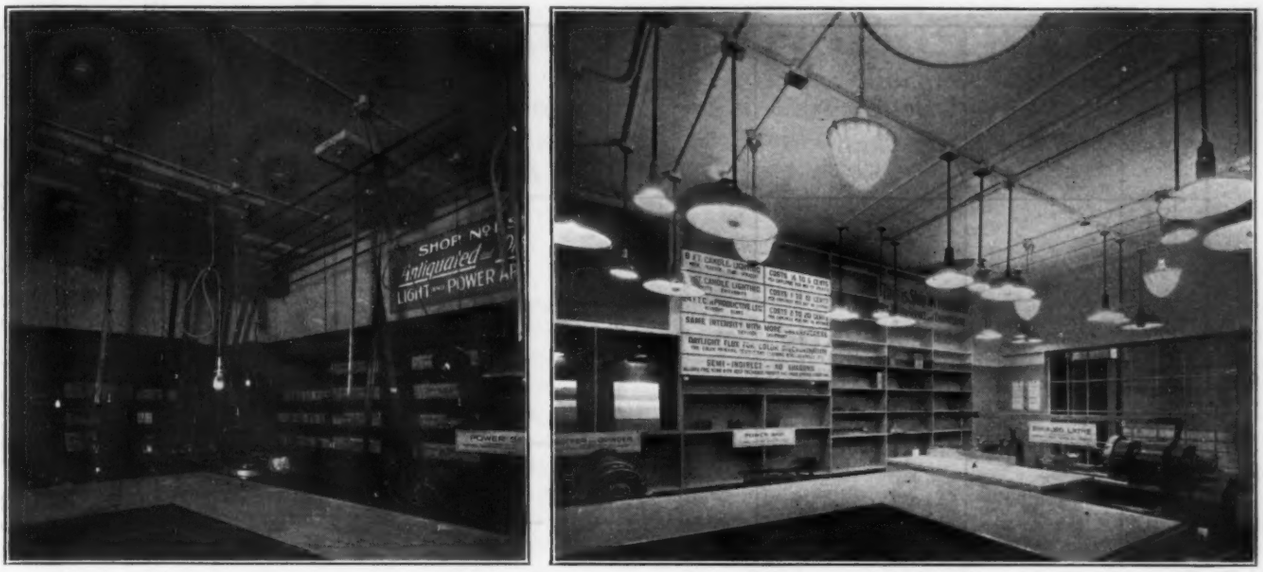



FIG. 1—ANTIQUATED VERSUS MODERN LIGHTING

These are photographs of the two machine shops installed in the downtown office building of the Commonwealth Edison Company, Chicago, to show the difference between inadequate and high-intensity lighting. In the shop to the right seven lighting combinations can be obtained and the printed signs on the back wall show which systems are in use at any one time. On the left side of this picture the color-matching test can be seen. The left-hand view shows the antiquated systems of many factories.

several additional types are shown along a wall in an adjoining room. On this wall back of each reflector is a chart showing the distribution curve and the technical information concerning each particular unit.

The company has divided its industrial customers into classes according to industry, and groups of customers are invited to visit this model machine shop every day. The demonstration induces manufacturers to ask what it would cost to have a modern lighting system installed in their factory, and the company has engineers whose time is devoted to preparing such reports and propositions for customers. Even before the machine shop was installed the company's salesmen were able to interest industrial concerns in the advantages of high-intensity lighting and to get permission for the company's engineers to submit recommendations and estimates of cost. However, it has been much easier to arouse interest in better lighting since it has been possible to give demonstrations under such favorable conditions.

Although the Commonwealth Edison Company makes complete specifications and estimates for all prospective customers, it is not primarily interested in making the actual installation. It would rather have local contractors take the job, permitting the company to check it so as to make sure that the specifications are followed out.

The company's industrial lighting campaign has resulted in the installation of 8,515 factory units with an additional connected load of 1,700 kw. during the last four months. This was accomplished with six engineers working up industrial lighting propositions, but the business that can be obtained in a given time is limited only by the number of men that can be obtained to do the engineering and installation work.

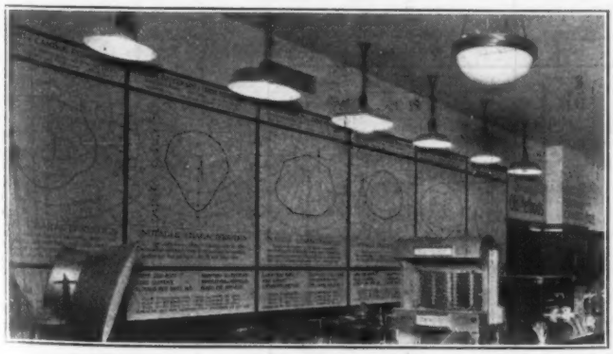


FIG. 2—DEMONSTRATING INDUSTRIAL LIGHTING UNITS

The entrance to the two machine shops shown in Fig. 1 may be noted in the right background of this photograph. Industrial lighting units which could not be hung in the store are shown on exhibition on the left-hand side of this photograph. The technical data are on the wall behind each unit.

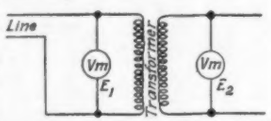
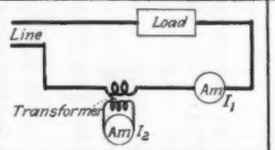
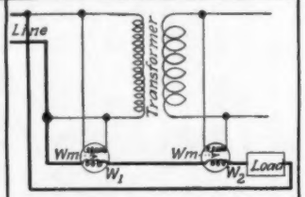
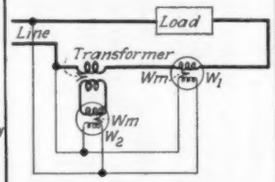
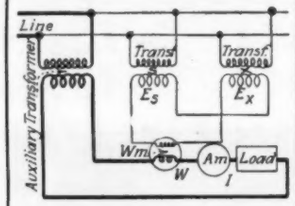
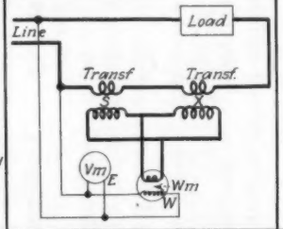
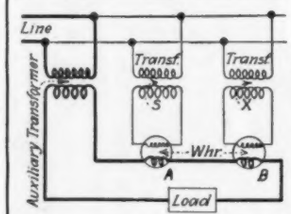
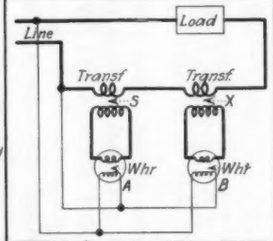
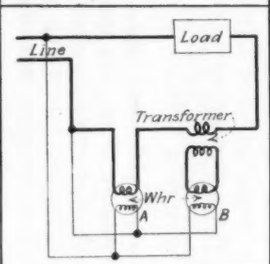
## Hydro-Electric Possibilities in Transcaucasia

THE United States trade commissioner at Constantinople, Elliot G. Mears, predicts a great development in the use of water power for electricity in Transcaucasia. The mountainous character of the country and the proved mineral wealth are the two important factors that will make these undertakings commercially profitable.

The total yield of existing hydro-electric stations is only 6,725 hp., although surveys have indicated that over 350,000 hp. is possible. A report of leading engineers presents specific data on the region that covers, roughly, Russian Armenia and the de facto republics of Azerbaijan and Georgia.

The furnishing of cheap electric power in the Caucasus will influence the development of the productive forces of the country, notably in agriculture, mining and the exploitation of the forests. It will aid also in the lighting question and in promoting and improving various kinds of internal communication. An electrochemical industry is sure to follow, in the opinion of Mr. Mears, such as the extraction of nitrogen from the air, which would naturally lead to the production of important chemicals, dyeing, artificial manure, ammonia, potassium, aluminum, chlorine, carbide of calcium and other chemical substances.

# CLASSIFICATION OF FIELD METHODS OF TESTING INSTRUMENT TRANSFORMERS

| Type of Test | Quantities Measurable | VOLTAGE TRANSFORMER: Simplified Connections | VOLTAGE TRANSFORMER: Equations for Ratio Factor | VOLTAGE TRANSFORMER: Equations for Phase Angle | Comments | Estimated Accuracy Obtainable | CURRENT TRANSFORMER: Simplified Connections | CURRENT TRANSFORMER: Equations for Ratio Factor | CURRENT TRANSFORMER: Equations for Phase Angle | References |
|---|---|---|---|---|---|---|---|---|---|---|
| I Absolute (voltmeter) (ammeter) | Ratio Factor Only |  | $F = \frac{E_1}{E_2 R_m}$ | | Accurately Calibrated Instruments of widely different Ranges required Fluctuations Affected by Voltage | In the Field 1% In the Laboratory $\frac{1}{4}$ of 1% |  | $F = \frac{I_1}{I_2 R_m}$ | | |
| II Absolute (wattmeter) | Ratio Factor and Phase Angle |  | When $\theta = 0°$ $F = \frac{W_1}{W_2 R_m}$ | When $\theta = 90°$ lagging $\cos(90°+\beta) = \frac{W}{E_2 I_2}$ | | In the Field 1% In the Laboratory $\frac{1}{4}$ of 1% |  | When $\theta = 0°$ $F = \frac{W_1}{W_2 R_m}$ | When $\theta = 90°$ lagging $\cos(\theta-\alpha) = \frac{W_2}{E I_2}$ | |
| III Comparative (differential) | Ratio Factor and Phase Angle |  | When $\theta = 0°$ $F_x = F_s\left[1+\frac{W}{I E_s}\right]$ | When $\theta = 90°$ lagging $\tan(\beta_x - \beta_s) = \frac{W}{I E_s}$ | Independent of Voltage Fluctuations Standard Transformer of known Characteristics and Instruments of only Reasonable Accuracy Required | In the Field $\frac{1}{4}$ of 1% In the Laboratory $\frac{1}{10}$ of 1% |  | When $\theta = 0°$ $F_x = F_s\left[1+\frac{W}{E I_s}\right]$ | When $\theta = 90°$ lagging $\tan(\alpha_x - \alpha_s) = \frac{W}{E I_s}$ | Brooks, Bull. Bur. Stds. Vol. 10, p. 419, 1914 El. Wld. Vol. 62 p. 898 Nov. 1, 1913<br>Silsbee, El. Wld. 1917 Vol. 70 p. 667<br>Crothers, El. Wld. 1919 Vol. 74 p. 119 |
| IV Comparative (Agnew) | Ratio Factor and Phase Angle |  | When $\theta = 0°$ $F_x = F_s + \frac{F_s}{2}\left[\frac{a_s - a_x}{a_x} + \frac{b_s - b_x}{b_x}\right]$ or $F_x = F_s + \left[\frac{b_s - b_x}{2 a_s}\right]$ | When $\theta$ is lagging and $\neq 0°$ $\beta_x = \beta_s + \frac{3438}{\tan\theta}\left[\frac{a'_s - a'_x}{2a_s} + \frac{b'_s - b'_x}{2b_s} - \frac{F_x - F_s}{F_s}\right]$ or $\beta_x = \beta_s + \frac{3438}{\tan\theta}\left[\frac{b'_s - b'_x}{2a_s} - \frac{b_s - b_x}{2a_s}\right]$ or When $\theta = 60°$ lagging $\beta_x = \beta_s + 20\left[\frac{100(b'_s - b'_x)}{2a_s} - \frac{100(b_s - b_x)}{2a_s}\right]$ | Independent of Voltage Fluctuations Standard Transformer of known Characteristics Required Uncalibrated Watthour-meters may be used | In the Field $\frac{1}{4}$ of 1% In the Laboratory $\frac{1}{10}$ of 1% |  | When $\theta = 0°$ $F_x = F_s + \frac{F_s}{2}\left[\frac{a_s - a_x}{a_x} + \frac{b_s - b_x}{b_x}\right]$ or $F_x = F_s + \left[\frac{b_s - b_x}{2 a_s}\right]$ | When $\theta$ is lagging and $\neq 0°$ $\alpha_x = \alpha_s - \frac{3438}{\tan\theta}\left[\frac{a'_s - a'_x}{2a_s} + \frac{b'_s - b'_x}{2b_s} - \frac{F_x - F_s}{F_s}\right]$ or $\alpha_x = \alpha_s - \frac{3438}{\tan\theta}\left[\frac{b'_s - b'_x}{2a_s} - \frac{b_s - b_x}{2a_s}\right]$ or When $\theta = 60°$ lagging $\alpha_x = \alpha_s - 20\left[\frac{100(b'_s - b'_x)}{2a_s} - \frac{100(b_s - b_x)}{2a_s}\right]$ | Agnew, Bull. Bur. Stds. Vol. 11, p. 347, 1915 El. Wld. Vol. 64, p. 1004 1914<br>Crothers, El. Wld. 1919 Vol. 73 p. 516 |
| V Absolute (Agnew) | Ratio Factor and Phase Angle | Not adapted to the testing of commercial types of voltage transformers since such transformers cannot conveniently be changed to have a 1:1 ratio | | | Independent of Voltage Fluctuations No Standard Transformer Required Uncalibrated Watthour meters may be used Can be used only for "loop-thru" type cur. Tr. | In the Field $\frac{1}{4}$ of 1% In the Laboratory $\frac{1}{10}$ of 1% |  | When $\theta = 0°$ $F_x = 1 + \left[\frac{b_s - b_x}{2 a_s}\right]$ | When $\theta$ is lagging and $\neq 0°$ $\alpha_x = 0 - \frac{3438}{\tan\theta}\left[\frac{b'_s - b'_x}{2a_s} - \frac{b_s - b_x}{2a_s}\right]$ or When $\theta$ is 60° lagging $\alpha_x = 0 - 20\left[\frac{100(b'_s - b'_x)}{2a_s} - \frac{100(b_s - b_x)}{2a_s}\right]$ | Knopp, El. Wld. Vol. 67, p. 92<br>Crothers, El. Wld. Feb. 7-1920 |

# Testing of Instrument Transformers—IV

## Analysis of Available Methods, Pointing Out Particularly Those Which Are Most Easily Applicable Under Ordinary Conditions Found by Central Stations in the Field and in Their Meter Shops and Laboratories

By F. A. KARTAK

*Formerly Director Standards Laboratory, University of Wisconsin*

DURING the past few years the standards laboratory of the University of Wisconsin has been requested a number of times by public utilities of the state to recommend methods for testing instrument transformers which, while giving a reasonably high degree of accuracy, would not require the use of precise and expensive laboratory apparatus nor the services of a specially trained expert.

In attempting to fix upon the best methods to be recommended for determining the constants of instrument transformers both in the field and in the meter shops or laboratories of central stations an analysis of the various available methods has been made. The analysis as carried out was not only based upon a theoretical consideration of the principles involved, but the various schemes or methods were tested experimentally under typical conditions both in the laboratory and in the field. Detailed discussions of some of these methods have already been presented in these columns.[1] The results of this analysis have shown some interesting conclusions which are here presented.

TABLE I—INSTRUMENT TRANSFORMER TERMINOLOGY

| Quantity | Symbol | Defining of Equation | Remarks |
|---|---|---|---|
| Marked or nominal ratio | $Rm$ | ..... | Nominal Ratio as Marked on Nameplate |
| Voltage ratio | $Re$ | $Re = \frac{Ep}{Es}$ (for voltage transformer) | Actual ratio of primary voltage (or current) to secondary voltage (or current) |
| Current ratio | $Ri$ | $Ri = \frac{Ip}{Is}$ (for current transformer) | |
| Ratio factor | $Fe$ | $Fe = \frac{Re}{Rm}$ (for voltage transformer) | Voltage (or current) ratio expressed in terms of marked ratio |
| | $Fi$ | $Fi = \frac{Ri}{Rm}$ (for current transformer) | |
| Phase angle | $\beta$ | (For voltage transformers) | The small angle by which the reversed secondary voltage (or current) *leads** the primary voltage (or current) |
| | $\alpha$ | (For current transformers) | |
| Power ratio | $Rw$ | $Rwe = \frac{EpIp \cos \theta}{EsIp \cos (\theta + \beta)}$ | Ratio of true power of circuit to apparent power in secondary circuit of transformer |
| | | $Rwi = \frac{IpEp \cos \theta}{IsEp \cos (\theta - \alpha)}$ | |
| Meter power factor | $\cos (\theta + \beta)$ | (For voltage transformer) | Operating power factor of meter connected to secondary circuit of transformer |
| | $\cos (\theta - \alpha)$ | (For current transformer) | |

* If the reversed secondary voltage (or current) *lags* the primary voltage (or current), the phase angle $\beta$ (or $\alpha$) is assumed negative and given a negative sign.

Before studying the various methods it was thought advisable to define the constants of transformers in such manner that the equations developed for the various methods might take the simplest or most convenient forms. A set of such definitions, defining equations and symbols, is presented in Table I. The use of "ratio factor" instead of "ratio" has been found to be particularly useful, since it not only readily permits the comparison of the characteristics of transformers of different ratios, but is quite useful where indicating instruments or watt-hour meters are connected in the secondary circuits of transformers, the percentage error in the meter indications or registrations due to error in transformer ratio being at once apparent.

In studying the situation only such methods were considered as could properly be classed as "field" methods; that is, methods which could be applied in the field, using engineering instruments (such as ammeters, voltmeters, wattmeters and watt-hour meters) rather than the more precise laboratory methods, requiring the use of reflecting dynamometers, special shunts, phase shifters and the like.

The methods available naturally divide themselves into two classes, which are termed "absolute" and "comparative" methods. "Absolute" methods are considered as those in which the constants (ratio factor and phase angle) of a transformer are determined directly from its operation under given conditions, while the "comparative" methods are those in which the constants of a given transformer are compared with the known constants of another transformer of the same nominal ratio.

### Usefulness of Various Testing Methods

In the chart on page 1368 has been grouped practically all of the desired information relating to the various types of tests, which are five in number. It will be seen that for every type of voltage transformer test there is a corresponding type of test for current transformers.

Type II test differs from type I test in that the use of indicating wattmeters in place of voltmeters or ammeters makes possible the determination of phase angle as well as ratio factor when a second circuit of displaced phase is used. As indicated in the table, neither of these methods is usually satisfactory because of the widely different ranges of accurately calibrated meters required and because any fluctuation of voltage of the supply circuit affects the accuracy of the readings.

The differential methods (type III) suggested by Brooks[2] for voltage transformers, Silsbee[3] and Crothers[4] for current transformers are particularly useful where a standard transformer—one of known characteristics—of the same nominal ratio as the transformer to be tested is available. The method is virtually independent of fluctuation of the supply voltage and requires only a low-range wattmeter of reasonable accuracy, since any error in the wattmeter indication enters only into the differential quantity being measured, that is, into the *difference* in voltages or currents of the two transformers being compared. The Brooks method with modifications, as described by Crothers[4], has been

[1] Crothers, ELECTRICAL WORLD, March 15, 1919; July 19, 1919, and Feb. 7, 1920.

[2] Brooks, ELECTRICAL WORLD, Vol. 62, p. 898, Nov. 1, 1913.
[3] Silsbee, ELECTRICAL WORLD, Vol. 70, p. 667, Oct. 6, 1917.
[4] Crothers, ELECTRICAL WORLD, Vol. 7, July 19, 1919.

adopted by the standards laboratory of the University of Wisconsin for the testing of voltage transformers.

The "comparative" Agnew test (type IV) is perhaps the most useful type which the small central-station meter shop will find available, particularly with the modifications worked out at the standards laboratory and presented by Mr. Crothers[5]. The method is independent of voltage fluctuations and requires only the use of two portable standard watt-hour meters or their equivalent. The watt-hour meters need not be accurately calibrated since they are interchanged during the test to eliminate any differences in their adjustments.

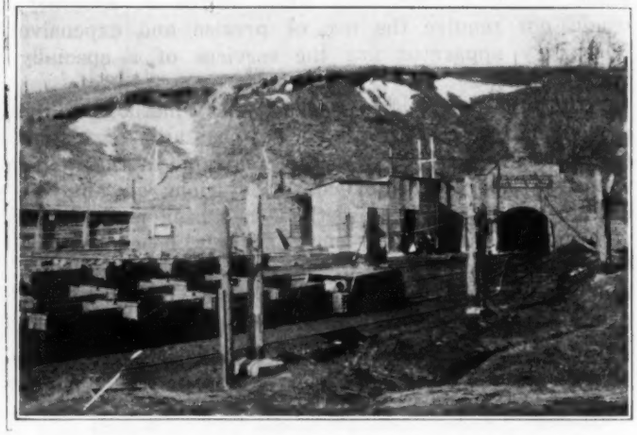
The "absolute" Agnew test[6] (type V), which is applicable only to the test of a current transformer of the "hole" or "loop through" type, combines all of the advantages of the "comparative" Agnew test (type IV) together with the fact that no standard transformer of known characteristics is required, the secondary current being compared with the primary current, as to both magnitude and phase position, after placing the proper number of primary turns to give the transformer a nominal one-to-one ratio. This method is obviously not applicable to commercial voltage transformers, since such transformers cannot be made to have a one-to-one nominal ratio. The Agnew method, both comparative and absolute, has been adopted by the standards laboratory of the University of Wisconsin for the testing of current transformers.

The estimated values of the accuracies obtainable in the various methods have been conservatively chosen after conducting tests by the different methods both in the laboratory and in the field, and it is believed that no difficulty will be encountered under ordinary conditions in obtaining results to the degrees of accuracy stated. By taking considerable care in observations it has been shown that the degrees of accuracy can be appreciably increased, particularly in tests carried out in laboratories or meter shops where it is possible to control conditions more closely than in the field. It is felt that under such conditions, in the case of type III, IV and V tests, the values of one-tenth of 1 per cent given may be changed to one-twentieth of 1 per cent and even to one-thirtieth of 1 per cent in the case of the absolute Agnew test where no standard transformer is required.

## Alternating-Current Service Facilitates Mine Extensions

On reaching the point where the direct-current energy supplied for the operation of the St. David (Ill.) mine of the Big Creek Coal Company was inadequate for the requirements, it was found that the most economical solution of the problem was the closing down of the mine power plant and conversion to central-station energy. The inadequacy of the direct-current energy was both a question of a lack of capacity and of ability to meet demand conditions. These conditions had been changing because the mine was of the drift type and the scene of operations had begun to get farther and farther away from the power plant. This caused a material reduction in the voltage applied to the electric drilling machines. Production was hampered, and in addition the hauling capacity of the electric locomotive was lowered. The locomotives have a 2-mile (3.2-km.) haul, and their decreased speed became an important factor. Although the voltage could have been corrected by the installation of larger copper feeders, this would not have been entirely satisfactory, because the time was bound to come when the drilling operations were again so far from the power plant that production would be reduced.

For these reasons the mine power plant was shut down and equipment was installed to convert the alternating-current supplied from the 13,200-volt transmission line of the Canton (Ill.) Gas & Electric Company. Two motor-generator sets are used, one, rated at 100 kw., at the mouth of the mine, and the other, rated at 200 kw., 1½ miles (2.4 km.) northwest of the main entry, directly over and 70 ft. (21 m.) above the main tunnel. The first set, besides supplying energy to the 6-mile (9.6 km.) mine feeder system, furnishes direct-current energy for the lights at the mine mouth and various motors in this vicinity. The purpose of the second set is to supply energy to the portion of the mine out of the range of the first set and to effect a good ventilation system for the mine. This is accomplished by means of a fan driven by a 25-hp. motor. Fresh air is furnished directly to the miners at the terminal of the mine. The power feeders in the mine are connected to this set by means of 1,000,000-circ.mil cable in a 2½-in. (6.3-cm.) "sherardized" conduit in the air shaft. This substation can be reached by traveling in the locomotive to the air shaft and then by climbing stairs.



MOUTH OF MINE SHOWING THE ELECTRIC LOCOMOTIVES

The endless-chain tipple at the mouth of the mine is driven by a 50-hp., 220-volt induction motor receiving energy from a 2,300/220-volt transformer connected to the 2,300-volt bus at the main switchboard. This motor replaces an old steam engine and was installed without delay to mining operations by reversing the shaft of the pulley. Thus the motors could be mounted on a new concrete base while the steam engine was still performing its duty.

Motor-generator sets were installed instead of rotary converters on account of the varying load requirements. The flashover which is common in high-frequency converters where a great number of poles are used is thus averted.

The installation of central-station service has increased the output of the mines about 20 per cent. Considerable saving of copper for feeders was also effected, and 10,000 lb. (4,500 kg.) of copper was removed.

The total connected load on the Canton Gas & Electric Company's service is now 175-hp. induction-motor load, 675-hp. synchronous-motor load and 6-kw. lighting load.

[5]Crothers, ELECTRICAL WORLD, Vol. 73, p. 516, March 15, 1919.
[6]Knopp, ELECTRICAL WORLD, Vol. 67, p. 92, Jan. 8, 1916, and Crothers, ELECTRICAL WORLD, Vol. 75, p. 319, Feb. 7, 1920.

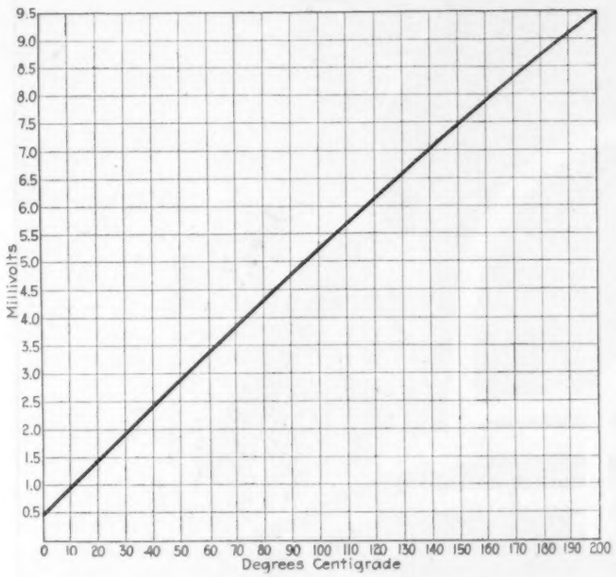
# *Readers' Views and Comments*

## Thermocouple Potentials

*To the Editor of the* ELECTRICAL WORLD:

SIR: On page 14 of the ELECTRICAL WORLD dated Jan. 3, 1920, an article appeared on the "Thermal Conductivity of Underground Ducts." In Fig. 2 of that article and in the discussion Mr. Wilder gives data which do not agree with the writer's data on copper-advance and copper-constantan couples. The paper is not entirely clear on the subject of cold-junction temperature, but inasmuch as the author refers to an ice-water bath, it is assumed that the cold junction was at a temperature somewhere near 0 deg. C.

Below Fig. 2 the author gives a value of 0.017 millivolt per degree change in temperature but does not state whether this refers to Fahrenheit or Centigrade degrees. From Fig. 2, this figure would appear to check with emf. values for Centigrade degrees. The writer's data show an emf. of about 0.04 millivolt per degree




CHARACTERISTIC CURVE FOR COPPER-CONSTANTAN THERMOCOUPLE, COLD JUNCTION 0 DEG. C.

Centigrade at the hot junction, with the cold junction at 0 deg. This is more than twice the value given by the author, so that it is difficult to interpret his results even though Fahrenheit degrees are assumed instead of Centigrade degrees.

The accompanying curve gives figures for copper-constantan or copper-advance couples, but it is desired to point out that this curve cannot be duplicated by selecting advance or constantan wire at random. Constantan and advance are alloys, and the thermal characteristics are not the same in every piece of wire. Accordingly wire must be carefully selected in order to reproduce the characteristics which are shown in the inclosed curve.

The potentiometer method for measuring thermocouple potentials is not new, and in fact instruments based on this principle have been carried to a considerable degree of refinement. The Leeds & Northrup Company makes a compact portable instrument calibrated to read directly in temperature units and having an automatic cold-junction compensator so that when making measurements the temperature of the cold junction can be ignored. An automatic potentiometer is also made for recording the temperature of one or more thermocouples. This same form of instrument has been very successfully adapted to temperature control problems. Like the indicating instruments these recorders and controllers are automatically compensated for cold-junction temperatures.

I. MELVILLE STEIN,
Leeds & Northrup Company.

Philadelphia, Pa.

## Farm-Line Service Has Become a Social Necessity

*To the Editor of the* ELECTRICAL WORLD:

SIR: Some time ago a representative of the United States Chamber of Commerce, in an interesting address before a gathering of central-station men at a convention in Chicago, laid particular stress on the lack of social conscience among American business men and pointed out that unless business organizations in general visualize their position in the business world as a social factor in the life of the nation they will not fulfill their mission. It is the duty of the business men of the nation to know their position and duty as a useful link in the nation's organization and always to place the benefits of the people in general above their immediate business gains. It is this quality that is defined as social conscience, and the necessity of this social conscience among central-station men is glaringly displayed at present, when service is being denied to farmers simply because there is often no immediate gain for the central-station company in carrying electricity to the rural customer.

Any one who has followed the continuous movement from the farms to the cities during the last two years can easily see for himself that if this movement is not stopped, the time is fast approaching when we shall have bread lines in the cities, due not to lack of money but to lack of bread. The fact is that the farmer cannot get sufficient help to raise the crops he used to raise. One solution for this difficulty is to make it possible for electric power to do the work that the hired man refuses to do.

If it were necessary for the central-station companies to furnish power to the farmers at a loss, the situation would be difficult and would call for men of large vision and unselfish motives to lead the "back to the farm" movement via central-station service, but such is not the case. The farmer is willing to pay for the necessary expense in giving him service, and it is just a question of the central-station man breaking away from his hobby of building large stations supplying large industrial loads and turning a part of his organization over to this very important duty of providing service for the farmers.

It is an excellent opportunity to gain the good will of our most conservative voters, insure their confidence in existing business institutions and incidentally develop a hitherto untouched field for central-station securities. The farmer who is satisfied with central-station service will be glad to buy securities in the corporation in which he is personally interested.

ALFRED ALSAKER.
Chicago, Ill.

# Station and Operating Practice

**A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy**

## Cutting Extra Oil Ducts Stops Transformers Overheating

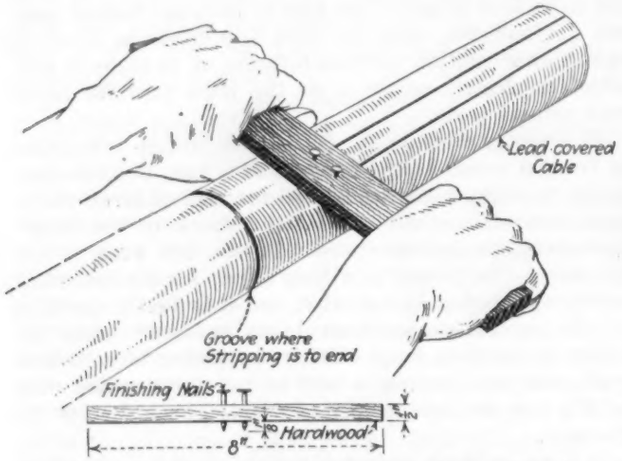
IN ORDER to eliminate heating of some 11,000 4,150-volt transformers of the Rochester (N. Y.) Gas & Electric Corporation additional oil ducts have been cut in the laminated cores and the iron cooling coils have been cleaned of scale and sediment. Seven of these 60-cycle transformers totaling 30,000 kva. have operated successfully at rated capacity for four years, but recently abnormally high temperatures have developed on account of insufficient oil-duct capacity and of obstructed water-cooling coils which are of iron instead of the preferable brass or copper tubing. To remedy the trouble it was found necessary to disconnect and dissassemble the transformers without interrupting service. After the laminated iron was removed additional slots were cut in the section between different phases to form extra oil ducts at the points where they were most needed. The iron cooling coils were then flushed with muriatic acid, which entirely removed the scale and sediment. Several transformers in which these changes have been completed are showing very satisfactory operation.

GEORGE BAILEY.

Rochester, N. Y.

## Tool for Stripping Lead Cable Sheath

FOR stripping the lead sheathing from cables the easily constructed tool illustrated here has proved very useful. The tool consists of a strip of hard wood, about 8 in. x 1½ in. x ½ in. (20 cm. x 3.5 cm. x 1.5 cm.), into which are driven two No. 6 finishing nails. The




TOOL CUTS TWO GROOVES IN SHEATH TO BE STRIPPED

nails are spaced from ⅜ in. to ¾ in. (1 cm. to 2 cm.) apart, depending on the size of cable to be stripped, and the ends of the nails are allowed to project ⅛ in. (0.3 cm.)

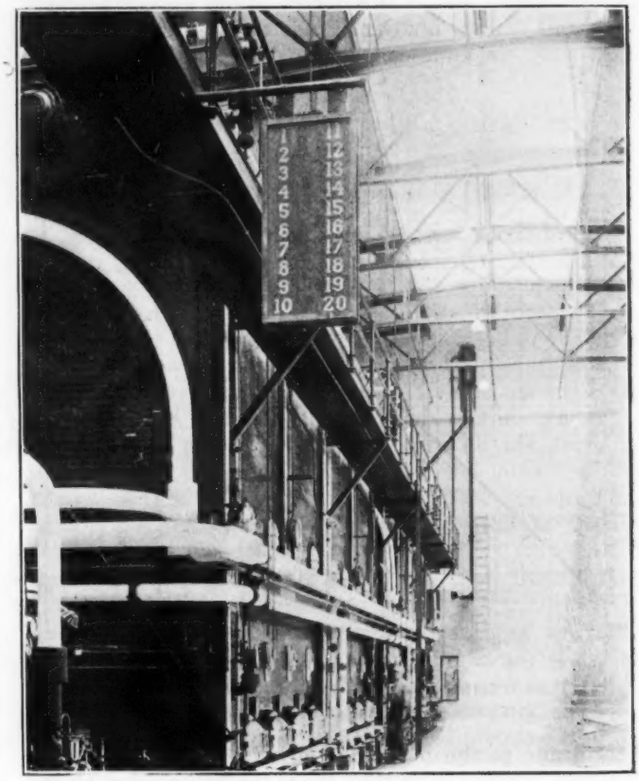
To operate the tool it is drawn along the cable, scoring two deep grooves in the lead. A limiting groove is also cut around the cable at each end of the section to be stripped. After this strip is removed by peeling back with heavy pliers, the remainder of the sheath is taken off by forcing a blunt tool between the sheath and the cable.

H. E. WEIGHTMAN.

Chicago, Ill.

## Indicator in Boiler Room Shows Load on Turbine

FOR keeping firemen constantly informed of the load on a bank of boilers, an illuminated indicator is mounted where it is easily seen in the Long Beach plant of the Southern California Edison Company. The indicator, as shown in the photograph, consists of a box-like frame having two glass sides on which are

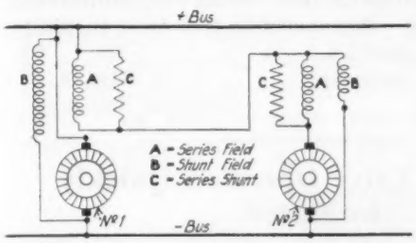



LIGHTED NUMBERS INDICATE OPEN TURBINE VALVES

painted numbers from 1 to 20, corresponding to the number of valves on the turbine fed by the particular bank of boilers. Behind each of the numbers is an incandescent lamp which is lighted when the valve corresponding to that number is open. As the valves open in proportion to the load carried, if the steam pressure is constant, the firemen are able to keep close watch of the load and to regulate their fires accordingly. As this plant is an oil-burning plant, it is a simple matter to shut down or start up a boiler within a few seconds. An indicator is installed on each of the three banks of boilers in this plant, each bank feeding only one turbine.

## Parallel Operation of Unsimilar Direct-Current Generators

THE difficulty sometimes found in the parallel operation of direct-current generators can be overcome by connecting the two machines together as shown in the accompanying drawing. One of these machines may be overcompounded and the other undercompounded, and both may be driven by separate prime movers. The proper proportion of load is obtained by adjustment of the compound field shunts and the shunt-field rheostat. With proper adjustment the machines will divide the load as though tied together with an inflexible coupling. Treating this unit as a single unit, it in turn can be coupled to other units. In case of any difference in rating of the two machines No. 2 should be the smaller.




SEPARATELY DRIVEN GENERATORS CONNECTED FOR PARALLEL OPERATION

By referring to the drawing the action is seen to be as follows: As No. 1 generator is connected to the line as a simple shunt machine, when called on for current there will be an immediate drop in voltage due to armature reaction and $I^2R$ loss. No. 2 generator then starts delivery of current which passes through the compound winding of generator No. 1 and thus raises its voltage.

In a specific case the No. 1 generator was a 250-kw., 500-volt machine, 25 per cent overcompounded, belted to a cross-compound Robb-Armstrong engine. The No. 2 generator was a 125-kw., 500-volt machine, 25 per cent undercompounded, connected to a second Robb-Armstrong engine of the same type. The series shunt on No. 2 generator was removed entirely and the series shunt on the No. 1 machine was adjusted to give the desired proportion of load in each machine. The result was a perfect parallel orperation.

B. N. EMMET.

San Francisco, Cal.

## Branding Poles to Check Depth of Setting

AFTER a pole is set in the ground it is usually impossible to tell the depth of setting. To check the depth to which poles have been set the San Joaquin Light & Power Corporation brands the poles at the time of shaping about 8 ft. or 10 ft. (3 m.) from the lower end. This is a very simple process and makes it possible to judge just how deep the pole is planted by the distance of the brand above the ground. The only way to avoid having to dig a hole of the proper depth is to saw off the pole, which involves as much labor as digging the hole deeper and can be easily detected. The stencil used is simply an ordinary branding stencil with cast-iron letters "SJL&P Corp." which are heated red-hot and burned into the pole.

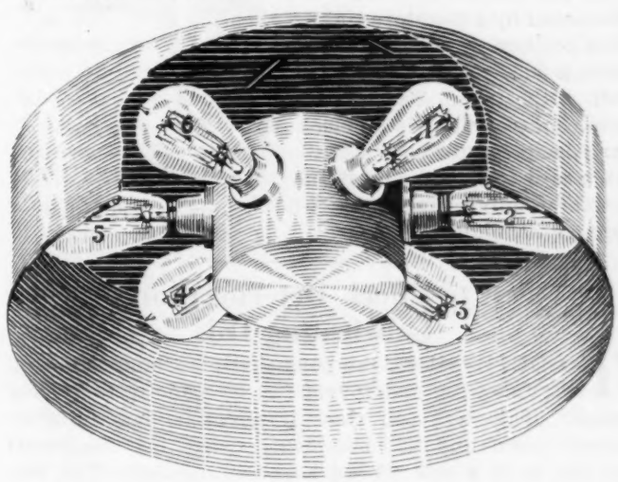
This method was adopted after a high wind some years ago had blown down several poles which according to all calculations should have withstood the wind pressure. It was found that the contractor who set up the line had not sunk the poles to the required depth but had saved himself the trouble of digging holes deeper than 3 ft. (1.8 m.). In order to obviate a repetition of this difficulty and make such a fraud impossible without too expensive inspection, the company now uses the scheme of stenciling the poles as described.

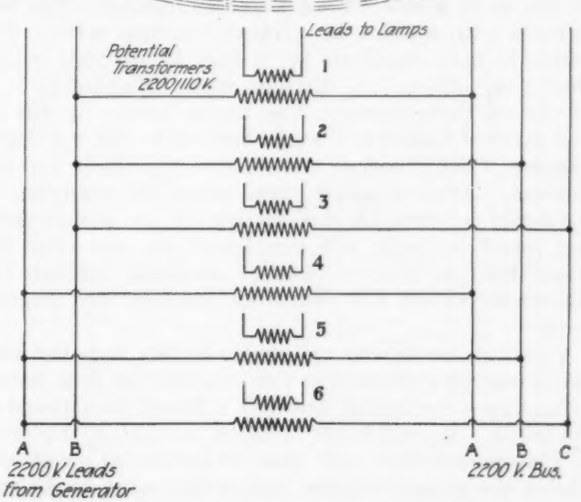
L. J. MOORE,
Electrical Engineer.

San Joaquin Light & Power Corporation,
Fresno, Cal.

## Rotating-Light Synchroscope Easily Seen at Distance

SIX incandescent lamps mounted in a circular trough, as shown in the accompanying illustration, form a synchroscope used in the Borel plant of the Southern California Edison Company. The lamps are mounted on a small cylinder and around the whole is the inclosing circular rim. In synchronizing, only one lamp burns brightly at a time, and this condition passes from one lamp to the next around the circle, giving the appearance of a rotating streak of light. This light throws a shadow on the inside of the rim which may be seen from almost any part of the room. To add to the brightness the interior is painted white.




HOME-MADE SYNCHROSCOPE AND CONNECTIONS FOR LAMPS

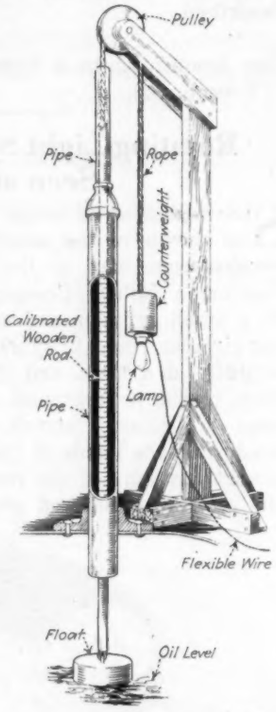
The connections require six potential transformers wired, as the diagram shows, to two legs of the leads from the generator to be synchronized and to the three legs of the station bus.

J. O. BANGSBURG.

Southern California Edison Company,
Los Angeles, Cal.

## Gage to Measure Height of Oil in 30,000-Barrel Tanks

A QUICK and easy means to ascertain the height of fuel oil stored in the supply tank for large steam-electric power plants is a matter of considerable importance. The North Beach plant of the Sierra & San Francisco Power Company has a unique and helpful installation to ascertain the height of oil quickly. As shown in the illustration, the rod inside the pipe is calibrated in feet and inches and passes down into the tank, which is of 30,000-barrel capacity. This rod rests on a float supported by the oil. The weight of the rod is balanced by a counterweight, the position of which gives a rough idea of the height of oil in the tank. Attached to the counterweight is an electric lamp fed through a flexible cord so that the position of the counterweight may be known at night.




HEIGHT OF ROD SHOWS LEVEL OF OIL IN TANK

## Test to Check Deterioration of Lubricating Oils

TO DETERMINE the condition of a lubricating oil the following simple test can be made in the power plant. This test will show if an oil is beginning to break down and is consequently becoming dangerous to use, or if a new oil has been acid-treated. The test is made with a tall 4 oz. (114 c.c.) sample bottle. The bottle is first sterilized by boiling in distilled water, then 1 oz. (28 c.c.) of distilled water is added to 1 oz. of the oil to be tested. The bottle containing the oil and water is heated in a water bath up to 180 deg. Fahr. (83 deg. Cent.), corked and shaken vigorously for five minutes. After standing three hours the condition of the liquid is noted. A good filtered oil, not broken down and free from acid, will completely separate from the water with no layer or line of emulsion between the oil and water and will retain its clearness and original color.

To aid in measuring the liquids in this test, the 4-oz. bottle may be graduated at the 1-oz. and the 2-oz. points by making a horizontal line with a file on the outside of the bottle. Several bottles may be marked in this way, so that comparative tests may be conducted on several oils at the same time and under the same conditions. In this way an oil in use may at times be compared with new oil to see if it is beginning to break down and become dangerous. This test can easily be applied to turbine oils in the plant where they are used. After a little experimenting an oil that is beginning to break down or contains acid can readily be distinguished.

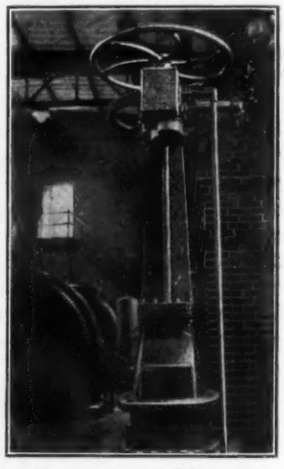
This emulsification test is important for oils used in steam turbines, splash feed, crank-case steam engines and circulating oiling systems. In some cases oil must separate from water readily and retain this property during use. With motor oils a filtered oil can be detected from an acid-treated oil.

Color does not indicate the lubricating value of an oil. Highly filtered oils are paler than other oils of the same viscosity, but the color can also be lightened by acid treatment. Heavy oils have deeper colors than light oils. Red engine oils should be clear when held toward the light in a sample bottle. Cylinder oils are green in color instead of black if free from tar. All mineral oils show more or less "bloom" or fluorescence, unless it is removed. Oils should be free from turbidity, which indicates impurities.

Consumers Power Company, Jackson, Mich. C. D. BASLER, Chemical Engineer.

## Hydraulic Valve Operated Quickly by Motor

AS IT is a slow, difficult process to operate a 36-in. (92-cm.) hydraulic gate valve by hand, the valves controlling the Francis waterwheels of two 5,000-kw. generators in a Michigan hydro-electric plant are equipped to be operated electrically by the Dean system. Each valve is equipped with a high-torque, totally inclosed, 125-volt, ball-bearing direct-current motor running at 1,600 r.p.m., which actuates the valve stem through a system of worm and planetary reduction gearing. Energy for operating these motors is taken from the exciter bus, and control stations are conveniently located in the power plant.



MOTOR OPERATES 36-IN. HYDRAULIC VALVE IN THREE AND ONE-HALF MINUTES

The control mechanism is so arranged that after the valve gate is fully opened or closed a mechanically operated clutch disconnects all high-speed parts, such as motor, gears, etc. Simultaneously the motor circuit is opened by a limit switch after which the motor usually makes about twenty revolutions, or one-half turn of the gear. These limit switches are set so that the motor will not overrun and jam the valve and burn out the motor. By means of this arrangement the motor starts without load and makes about twenty revolutions before the clutch starts the gears. The current then rises momentarily to 10 amp. at 110 volts, while unseating the valve, after which it drops to 5 amp., remaining fairly constant until the valve is fully opened or closed, the complete operation requiring about three and one-half minutes.

A hand wheel is provided so that the valves can be manually operated in case of failure of the motor or of the source of energy. An emergency storage battery was not considered necessary, as the equipment in the plant is in duplicate, and in any event sufficient power can be obtained through the bypass valve to drive the wheel and produce sufficient voltage on the exciter to operate the motor.

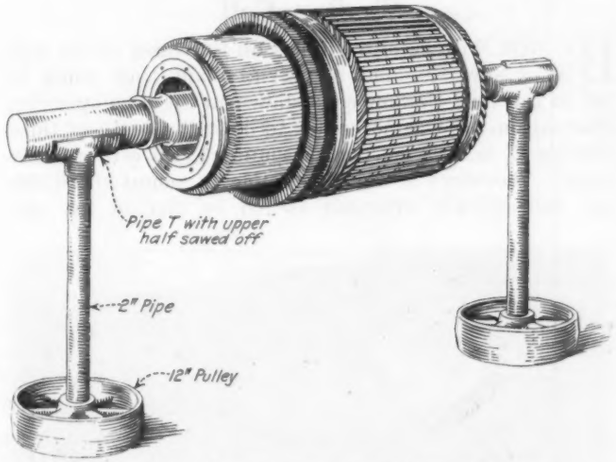
R. K. DURLAND.
Cleveland Cliffs Iron Company,
Ishpeming, Mich.

# Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

## Improvised Armature Support

FOR holding armatures which have been taken out of the frame to be worked on the support described here has proved very useful in an Eastern industrial plant. The stand is made from two 12-in. (30-cm.) pulleys which are set on the floor and into which are




ARMATURE STAND MADE FROM PULLEYS AND PIPES

inserted 2-in. (5-cm.) pipes about 3½ ft. (1 m.) long. To the upper end of each pipe which must be threaded is screwed a T-joint, of which the upper half of the cross member has been sawed off. Such a stand will accommodate motors from small sizes up to those with shafts the size of the T.

W. A. HARRIS.

New York, N. Y.

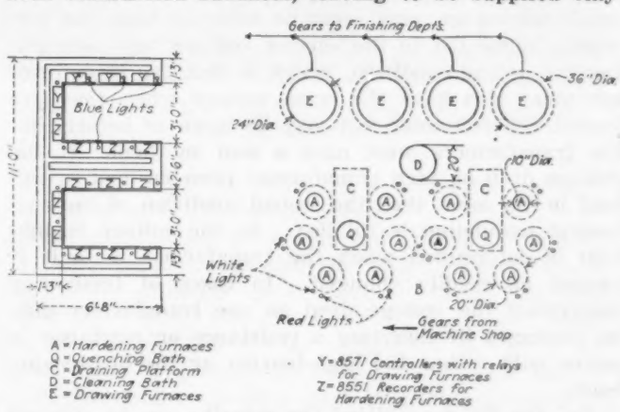
## Electric Heat-Treating of Automobile Gears

BY SUBSTITUTING electric heat-treating furnaces for the gas furnaces formerly used production operations have been greatly simplified in a large plant producing automobile gears. Moreover, the quality of the product has been improved while the output has been increased.

Formerly in this plant automobile transmission gears were heated for hardening in lead pots located in the basement beneath the machine shop. After the gears had been machined, they were removed on trucks to an elevator, lowered to the heat-treating room, an uncomfortable place because of heat and fumes, and wheeled to the lead pots. The gears were placed in the lead pots in batches and when they had come up to temperature were lifted out one at a time and dropped into the oil quenching bath. The time of heating in the lead pots was thus not the same for all pieces, and the temperature also varied with the location in the pot, possibly resulting in non-uniform hardness and grain structure. The gears were also sometimes injured by dropping upon one another in the quenching tank. The drawing was done in gas furnaces, followed by an oil quench. Upon their return to the machine shop the gears were wire-brushed to remove adhering lead.

The electric furnace equipment replacing the lead pots and gas furnace is installed in the machine shop itself as the layout diagram shows. There are six electric hardening furnaces placed on two sides about a quenching tank, with three electric annealing furnaces on the remaining side, also a drain grid and the cleansing bath between the quenching tank and the annealing furnaces. The tops of all furnaces and tanks are flush with an elevated platform. The work is brought on trucks to the edge of the platform, where a boy arranges the gears upon holders, which are easily picked up by the operator. Upon these holders the gears remain until they have passed in turn through hardening furnace, quenching tank, cleansing bath and drawing furnace. Corresponding to each hardening furnace, there is a curve-drawing recorder, and for each drawing furnace an automatic temperature-recording controller, all mounted upon a wall near by with the furnace rheostats. An assistant foreman on duty at this point directs the operations according to the indications of the curve-drawing recorders connected to the hardening furnaces.

The amount of electrical energy consumed by the electric furnace is comparatively little owing to efficient insulation. There is no loss of heat in waste gases as with combustion furnaces, leaving to be supplied only




LAYOUT OF SHOP FOR HEAT-TREATING GEARS

the heat imparted to the work. The higher cost of electrical energy is more than repaid by the saving in necessary apparatus, such as pumps, blowers, burners, etc., and the labor costs, as the electric furnace is installed in the machine shop in the direct line of manufacture, thus saving the double handling necessary where the work must be taken from the machine shop to a hardening room and then back again.

The method of heat treatment used in this plant,

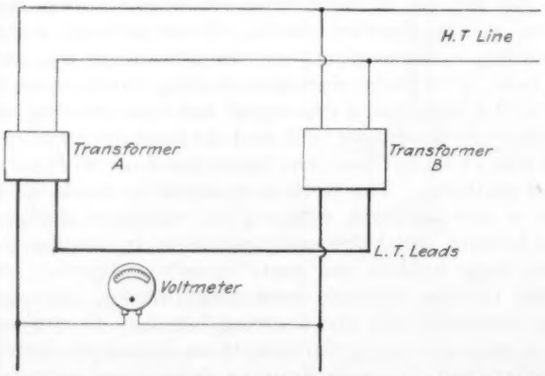
which is controlled by the Leeds & Northrup Company, Philadelphia, makes use of the fact that at a certain critical point in the heating a chemical change in the metal allows heat to be applied without proportionately raising the temperature. In electrical processes this point can be accurately judged by the use of indicating meters.

G. H. GIBSON.

New York, N. Y.

## Conditions for Successful Parallel Operation of Transformers

TO OPERATE in parallel transformers must have (1) no-load terminal voltage the same; (2) the same voltage regulation on load, and (3) the same polarity. The no-load terminal voltage may be measured by a voltmeter, in connection with a potential




CHECKING POLARITY OF TRANSFORMERS TO BE PARALLELED

If voltmeter reads zero, transformer may be paralleled. If voltmeter reads twice transformer voltage, low-tension or high-tension leads of one transformer must be reversed before paralleling.

transformer if necessary. As the voltage ratio on transformers is usually ten to one, twenty to one or some such simple ratio, the first condition is usually easy to fulfill. However, with large power transformers having voltage taps to change the voltage only a small percentage, care must be taken to have the terminals connected to the correct voltage tap. Regarding the second condition, which is that the transformers must also have the same voltage when they are loaded, the voltmeter test may be made as before, but the transformers must have a load on them. If the voltage drop on each transformer from no load to full load is the same, then the second condition of the successful paralleling is fulfilled. As the voltage regulation is determined when the transformer is built it cannot be readily changed. In cases of temporary emergency the voltage drop on one transformer may be increased by inserting a resistance or reactance in series with either the high-tension or the low-tension leads.

For the third condition the polarity can be checked by connecting the high-tension leads in parallel and connecting two corresponding low-tension leads together. With this connection the voltage across the two other corresponding leads should be zero. By connecting a voltmeter across these leads this voltage may be measured. A voltmeter of twice the voltage of the transformers should be used because if the polarity of one transformer is the reverse of that of the other, double voltage will be put upon the meter. In such a case the corresponding low-tension leads must be connected to opposite sides of the low-tension line.

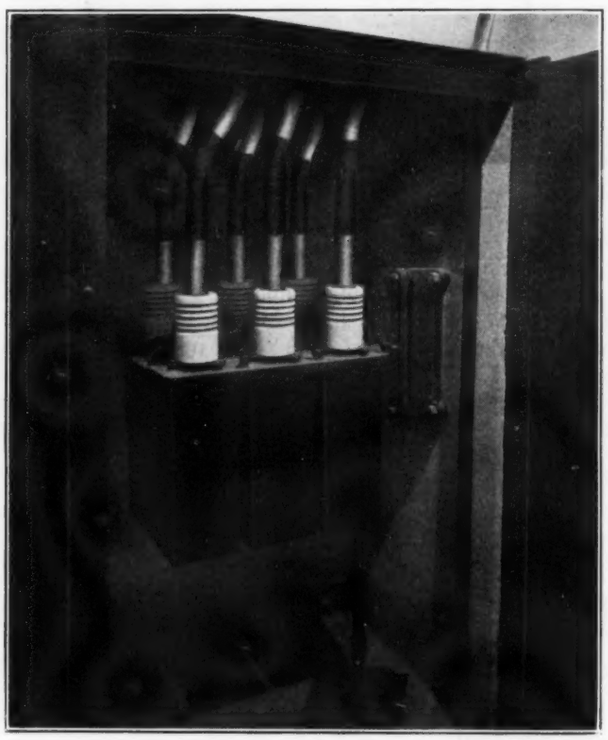
When a transformer is to be used as a tie between two systems both of which have generators running on them, the transformer leads must be treated in exactly the same manner as the leads of an alternator which is being cut in to a like system. The phase rotation in the two systems must be observed. This may be checked by noting the direction of rotation of a polyphase induction motor first on one system and then on the other. Another method is by means of phasing lamps. If the transformer is the only tie between the two systems, it can be cut in only when the two systems are in synchronism. This requires a synchronoscope or lamp used in the same manner as when paralleling alternators.

JAMES DIXON.

Cleveland, Ohio.

## Oil Switch Mounted on Side of Shallow Cell

BY MOUNTING oil switches on the sides of the cells in a New England industrial plant they could be put in the very shallow cells shown in the accompanying illustration. It was necessary to limit the depth of these cells to 27 in. (68 cm.) on account of real estate conditions. Therefore it was impossible to mount the 6,900-volt mechanically operated switch by placing the sup-



METHOD USED IN MOUNTING OIL SWITCHES TO SAVE ROOM

porting bracket at the rear of the cell, as the switch was 28 in. (71 cm.) long over all. By simply turning the axis of the switch 90 deg. and installing it upon the side wall of the cell a most convenient installation was obtained, with the further advantage of avoiding offsets or right-angled adjustment turns in the cables running to the disconnecting switches and busbars above. As the switch happened to be offset by several panels from its control point, a diagonal run of operating lever was provided in the floor as shown, after a convenient

sectional slab 9 in. (33.5 cm.) wide was cut in the concrete flooring and in the linoleum covering at the rear of the switchboard.

## Switchboard Useful for Motor Repair Shop

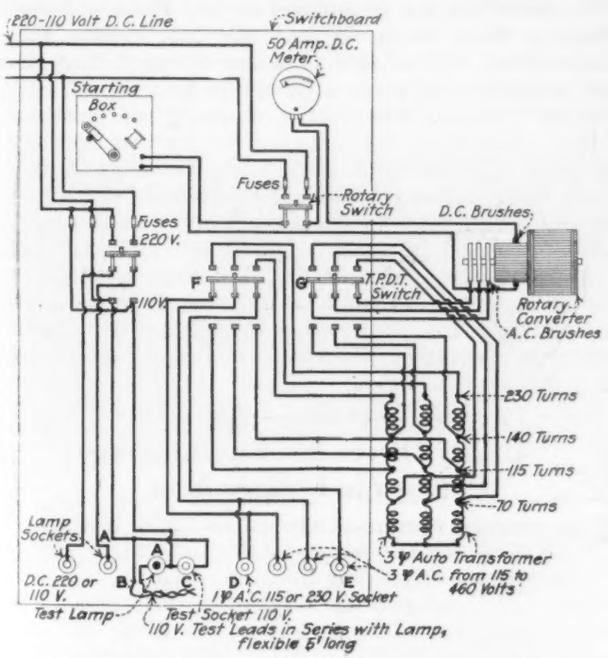
A CONVENIENT switchboard for providing alternating and direct current for testing purposes described here was constructed in a Western repair shop for use with a home-made rotary converter described in the ELECTRICAL WORLD, April 3, 1920, p. 793. Although designed for use with this converter, the switchboard may be connected to an alternating-current line in place of the converter where such a line is available.

Starting at the left-hand side of the board as shown in the illustration, the first two lamp sockets at the bottom of the board are for 110 volts or 220 volts direct-current. Both terminals of these sockets are soldered together so that a single-wire cord may be

CONNECTIONS OF ROTARY CONVERTER AND SWITCHBOARD

| Switch F. | Switch G. | Voltage on Three-Phase Plugs |
|---|---|---|
| Up | Up | 460 |
| Up | Down | 230 |
| Down | Up | 230 |
| Down | Down | 115 |

connected to them by means of a plug. The voltage is changed from 110 volts to 220 volts by means of the double-pole, double-throw switch. At *B* is a two-wire flexible cord, about 5 ft. (1.5 m.) long, connected in



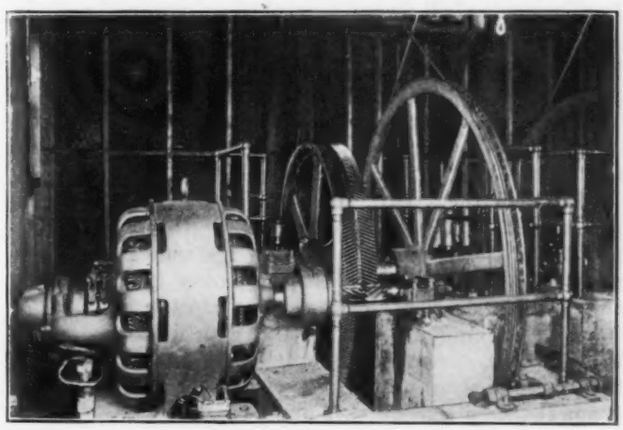

SWITCHBOARD CONVENIENT FOR TESTING IN A MOTOR REPAIR SHOP

series with the incandescent lamp across the 110-volt direct-current line. These leads are used for testing for grounds, open coils, etc. At *C* is a socket connected in the ordinary manner across the 110-volt direct-current line. At *D* is a socket connected in the same way across the alternating-current lines. At *E* are three sockets with terminals soldered together for three single-wire leads. On these sockets is three-phase alternating-current. These wires connect to the middle point of the double-throw, three-pole switch, *F*. Where 110/220 volt alternating-current is available, the outside terminals of this switch might be connected respectively to two lines of these voltages. However, in the present case the outside terminals are connected to taps of the auto-transformer, which is wound with 230 turns of No. 7 double cotton-covered wire on a three-legged core, each leg of which is 2¼ in. square and 12 in. high (5.5 cm. x 30 cm.). The rotary converter, which generates 70 volts, is connected to other taps of this auto-transformer through the switch *G*. By means of these two switches the voltage on the socket at *E* may be varied from 115 volts to 460 volts. The positions of these switches for the various voltages are given in the accompanying table.

Chicago, Ill. C. W. GODING.

## Single-Sheave Haulage Gives Reliable Service

ABOUT three years ago one group of iron mines in Michigan changed the drive on its surface haulage from endless rope with double-tandem drums to the single-sheave haulage sets shown in the illustration. The change has proved very satisfactory in



SINGLE-SHEAVE HAULAGE INSTALLATION FOR HANDLING SURFACE MINE STOCK

every way. This haulage is used to carry ore and other material in cars above ground.

Each set consists of a remotely controlled 50-hp., 2,200-volt, three-phase, 60-cycle, 600-r.p.m. (synchronous speed) slip-ring motor, geared to drive the rope on a 6-ft. or 8-ft. (1.8-m. or 2.4-m.) sheave at a speed of 1,000 ft. to 1,500 ft. per minute (5 m. to 7.5 m. per second). The motor is geared down about ten to one to permit the use of a large sheave and rope surface. The effective driving surface is further increased by crossing the rope as it leaves the sheave, and there is an automatic rope tightener at the end of each trestle. A ⅝-in. (16-mm.) rope is used, and each sheave is lined with rubber to minimize rope slippage. Some fifteen of these sets have been in use by one company for about three years without requiring a renewal of the rubber linings in the sheaves.

F. C. STANFORD,
Chief Electrical Engineer.
Cleveland Cliffs Iron Company,
Ishpeming, Mich.

# Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

## Possibilities of Electric Range Business

IT SHOULD not be many years before electric range sales are comparable with the present output of washing machines, according to close students of the progress of electric cooking. Some of the reasons on which this belief is based follow:

First—An electric range in its operation is as far in advance of a fuel range as washing machines are ahead of hand-tub methods.

Second—The average washing machine is used only four or five times a month. Domestic cooking, on the other hand, is an insistent, compulsory routine three times a day, and the more often any appliance is used the greater advantage accrues to the user.

Third—The household wash can be handled outside of the home and in a reasonably satisfactory manner. However, it is not generally desirable or likely that family meals shall or can be cooked or obtained outside.

Fourth—The cost of an electric range is comparable to that of an electric washing machine.

## Successful Local Financing of Small Companies

AMID all the credit difficulties which are besetting central stations large and small, profitable and unprofitable, the Greenville (Ohio) Electric Light Company has been able to get all the money it needed at a cost of virtually 7 per cent net. A block of $25,000 of 7 per cent cumulative preferred stock was sold at par last year at a cost of eighty 2-cent stamps plus the time necessary to dictate and write a form letter. For about the same expenditure of money this spring $125,000 of the same class of stock was disposed of, also at par. These two stock issues almost doubled the capitalization of the company, but nevertheless there was not sufficient stock to satisfy the wants of the buyers.

Many small companies have experienced more difficulties raising money than have the larger companies, because the amount required is often larger than the local banks can handle but too small an amount to interest the bankers at the large centers of finance. D. L. Gaskill, president of the Greenville Electric Light Company, believes that small independent companies must depend largely on the direct sale of securities to customers, local investors and employees. It is a testimonial to the standing of Mr. Gaskill's company in the community it serves that, although the stock sales were not advertised except in an announcement to stockholders and employees, the issues were both oversubscribed. Unfortunately, every company is not so favorably situated; but Mr. Gaskill said: "With intensive sales effort a company can usually sell its securities directly to investors cheaper than they can be sold through intermediary sources. Furthermore, companies can often raise money by direct sales when they could not sell securities to investment bankers at a satisfactory price. It is very desirable to make the interest rate such that the securities can be sold at par, and it is usually easier to do this by direct sales than through the medium of a banker or broker."

## Charge for Fuse Replacement Coming Into Favor

FREE replacement of fuses is becoming less popular in New England central stations, according to statements at the recent question-box convention of the New England Section of the National Electric Light Association at Boston. The Narragansett Electric Lighting Company, Providence, R. I., sends a man out from 6 p.m. to 7 a.m., on telephone call, to replace fuses free of charge, but if a call is received during the day, the customer is asked to go to an electrical contractor-dealer. Considering the cost of fuses, time of trouble-men, gasoline expense, etc., the yearly expense of fuse replacement by the Providence company is about $3,500. The Fitchburg (Mass.) Gas & Electric Light Company charges for fuse replacement, whether by day or night. The customers are encouraged to buy fuses and stock them in their homes, so that they may replace them themselves. At Hartford, Conn., no charge is made, but the company may make a change in this regard. The Edison Electric Illuminating Company of Brockton, Mass., charges for the fuses but not for transportation or time. The United Electric Light Company, Springfield, Mass., refers trouble calls to electrical contractors by day. At night a nominal charge of 75 cents is made, unless the cost of fuses, such as the main fuses in apartment blocks, exceeds this, in which case the cost of the fuse plus 75 cents labor is charged the customer. No difficulty has been had in explaining the reasons for such a charge to the customer, and no dissatisfaction has come to light.

## Utility Offers Six Engineering Courses to College Men

SIX practical courses in applied electrical, mechanical and civil engineering are being offered to college students and graduates by the Milwaukee Electric Railway & Light Company and associated companies. The length of each course is eighteen months and the work is laid out in six divisions. The men receive from $85 to $95 a month to start, depending upon the amount of college work they have done. The salary is then raised every three months, so that during the last three months of the course all the men are getting $120 a month. The salary they are paid after finishing depends upon the ability of the individual and the opportunities for advancement available at that time.

The electrical engineering course is subdivided into

meter testing, electric shop and customers' installations, station construction and maintenance, overhead lines, drafting and distribution engineering. The commercial engineering course covers meters and testing, shop and customers' installing, distribution lines, power plants, plant testing and commercial engineering. The combustion engineering course goes into the subject of power-plant combustion, plant testing (junior), plant testing (senior), plant records and plant design. In addition to these courses there are also courses in railroad equipment engineering, way and structures engineering and gas engineering.

## Electric Vehicle Technical School Started in Chicago

A COURSE of electrical instruction has been inaugurated by the Chicago Board of Education for the benefit of drivers, mechanics, garage employees, owners, salesmen and others interested in electric trucks and pleasure cars. In addition to the necessary machine shops, lecture rooms, testing laboratory and instruments, this school has been supplied with an illuminated wiring diagram. This is mounted on a board and equipped with lights which show the direction of the current through the electrical system of the vehicle at each notch of the controller. After visualizing what happens electrically when the controller is moved, the students are allowed to operate a truck where they are able to see the mechanical effects produced.

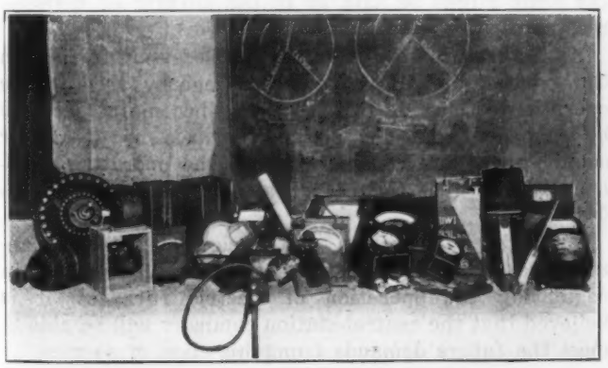
Instruction is given in the fundamental principles of electricity and magnetism, the use of electric measuring instruments, characteristics of electric motors and their control equipment, electric vehicle wiring, batteries, charging devices and machine-shop work. This comprehensive course was planned primarily for the benefit of electric vehicle men, but it is expected to disseminate a general knowledge of electrical subjects. The hours of instruction are from 1 p.m. to 5 p.m. on Mondays and Wednesdays, and the course extends over eight weeks. This is said to be the first school of its kind, and when the graduates get out into the electrical vehicle field they are expected to add to the prestige of electric vehicles and to pave the way for their more general use.

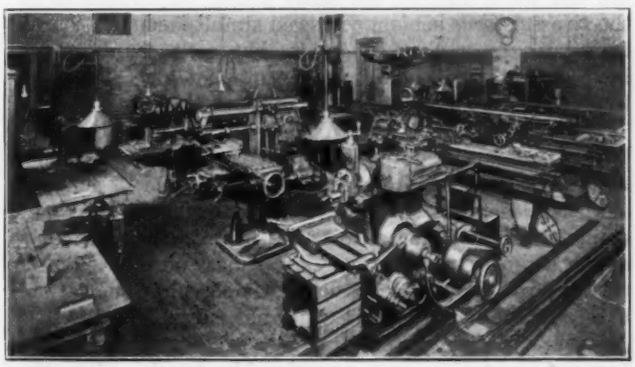
## The Electric Arc Furnace and the Central Station*

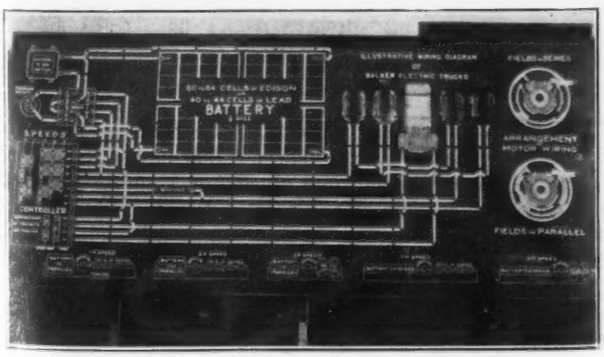
APPLICATION of the arc melting furnace is by no means limited to the steel foundry, but by degrees will find its way into the gray-iron, malleable-iron and brass foundries, and for certain specific purposes into the larger steel rolling mills.

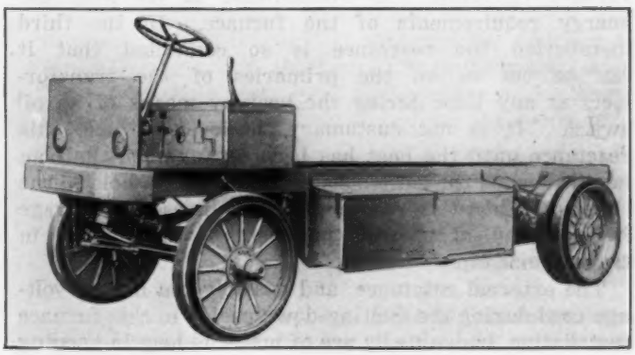
Power requirements of the arc furnace, varying instantaneously from zero demand to a short circuit, are more severe than any load the central station has been called upon to supply, and unless curbed in some manner may seriously retard the development of this field. This might be exemplified by a certain 3-ton, three-phase furnace installation in a steel foundry in Buffalo. The electric service is delivered at 11,000 volts to three 333-kva. transformers from a line used for no other purpose, and the automatic oil switch at the power company's substation end is set to open up at 320 amp., the equivalent of about 6,000 kva. It is a common occurrence for this switch to open up several times during every heat on the furnace. If there were ten, or even five, similarly operated furnace installations on this substation, which is not a future improbability in this

*Abstracted from a paper presented by Augustus C. Smith, sales engineer of the Buffalo General Electric Company, at the joint meeting of the American Electrochemical Society and the American Institute of Electrical Engineers.







EQUIPMENT OF TECHNICAL ELECTRIC VEHICLE SCHOOL

These photographs show the electrical measuring instruments, the machine shop, the 10-ft. x 6-ft. illuminated connection diagram and the electric road truck used by the students of the electric vehicle school in Chicago.

particular section of Buffalo, the power company would not be able to meet their combined demands.

Against such a possibility the central station must immediately fortify itself. Unless it is to discourage this class of service there must be moderation in furnace operation. The severe manner in which electrical energy is used in the above furnace is not due to furnace design but is caused by the method of operation.

An identical furnace installation in another steel foundry never exceeds a momentary maximum demand of more than 2,000 kva. In another instance the combined momentary maximum demand of two 10-ton three-phase furnaces rarely exceeds 6,000-kva. The feeder switch controlling this circuit is set for 640 amp., or the equivalent of about 12,000 kva., and very rarely opens up. External reactors are used with these furnaces to keep down excessive demands during the melting-down period.

The first steel-melting arc furnace to be installed in Buffalo and operated from central-station power was made in March, 1914. It was a 2-ton, single-phase hand-control furnace. The electrical energy furnished was three-phase, 2,200 volts, 25-cycle, transformed to 220 volts through two 750-kva. Scott-connected transformers. Current-limiting reactance was permanently installed between the transformers and the furnace, which limited the current flow to three and one-half times normal. While about 800 kw. was the maximum power required at the furnace, 1,500 kva. capacity was required on the primary of the transformers. Following this initial installation, a second furnace, similar in every respect to the first and with a like amount of reactance, was installed, a third 750-kva. transformer was added, and the three transformers were connected closed-delta on the primary. It was expected to obtain a better balancing of load across the three primary phases by the operation of the two furnaces, but this did not work out, as the same power requirements in the two furnaces seldom occurred simultaneously. These furnaces are still in operation, but on account of the low power-factor and phase unbalancing they are limited to the use of power at night only.

Here are four distinct furnace installations, the first two indentical in equipment and free from any external reactance, the third provided with removable 15 per cent external reactance, and the fourth with 30 per cent permanent external reactance. The first of the two without reactance uses about six times normal current rating during the melting-down period, while the second rarely if ever exceeds twice normal current rating. It is quite apparent, then, that the method employed in furnace operation has considerable to do with the energy requirements of the furnace. In the third installation the reactance is so connected that it can be cut in on the primaries of the transformers at any time during the heat by means of an oil switch. It is not customary, however, to use this reactance until the heat has been on for about half an hour, or when the electrodes begin to form a hole in the charge. When this reactance is put in use the voltage is increased about 100 per cent by a change in transformer taps.

The external reactance, and possibly the higher voltage used during the melting-down period in this furnace installation, undoubtedly are of material help in keeping down electrical surges, but are not alone sufficient entirely to prevent excessive use of energy, and the reason that these furnaces seldom exceed thir normal current rating is due to the operator's knowledge of both furnace operation and the electrical equipment used and to his skilled manner of handling.

Another furnace is ideal in its simplicity and comparatively free from very severe electrical surges, but on account of its low power factor and phase unbalancing is not acceptable to the central station as a day load.

The greatest difficulties which the central station is going to have from this class of service will come from furnaces which are improperly operated owing largely to the incompetency of the operator and the disregard of the strain put upon the power company's system.

Unless something shall be done to improve these conditions the central stations will be compelled to impose penalties to prevent automatically the reckless use of energy, and they may even be obliged to reserve the right to discontinue service to any furnace where such recklessness continues.

Particular attention should be paid to instructing a new operator how to charge his furnace properly. It is also suggested that a wiring diagram be furnished with every furnace installation. This would be invaluable to the central-station engineer if called upon for assistance in time of electrical trouble. It is believed that furnace transformers should be provided with three or four additional voltage taps, each tap connected with a switch so that the voltage at the electrode can be changed any time during the heat.

It is also believed that a small amount of external reactance, possibly 10 to 15 per cent, should be furnished and connected across a short-circuiting switch so that it can be put in or out of circuit any time during the heat.

Something more than the present electrical data available on furnace operation should be obtained before prescribing a standard for these transformer taps, and the same might be said as to the amount of external reactance to be used.

As the central stations will be called upon to furnish the greater part of the electrical energy used in the operation of electric furnaces, they become a factor to be regarded, and the electric furnace manufacturer should give more consideration to the operating problems with which the central-station company is confronted.

With the co-operation of the electric furnace manufacturers along these lines and their assistance in regulating the operation of electric furnaces, it is believed that the central-station company will be able to meet the future demands from this class of service.

## Merchandising Business of Providence Company 23 Per Cent Over Last Year

THE Narragansett Electric Lighting Company, Providence, R. I., has placed 1,000 new wiring contracts for house installations since Jan. 1 and is now taking new applications at the rate of fifteen a day. Sales of electrical merchandise in the company's various electric shops exceed those of last year to date by about 23 per cent. The company has planned to establish another electric shop for retail sales in Providence by June 1. Notwithstanding the shortage of electric motors, the company has succeeded in building up a stock which now is valued at about $40,000, and it is taking on new power business at a rapid rate.

# Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

## Generators, Motors and Transformers

*Current Distribution in Laminated Armature Conductors.*—F. PUNGA.—In order to cut eddy-current losses in heavy armature conductors, the copper is divided into several bars, which are insulated from each other and connected in paral'el. The stranding, however, is not effective unless the strands are so transposed that all the different strands have the same effective reactance, thus causing the current to distribute itself evenly over all the strands. This equalizing of reactance may be made in two ways. Either the composite conductor is twisted inside the slot or else the strands are carried parallel in the slot but are systematically transposed in the coil ends outside the slot. The latter system is taken up for a more detailed discussion, special attention being given to the case of fractional pitch windings.—*Elektrotechnische Zeitschrift*, Jan. 22, 1920.

*The Single-Field Cascade Machine.*—L. J. HUNT.—The writer describes a single-field type of machine for cascade connection in which only one core is used and the two component fields merge into a single resultant. The two individual stator and rotor windings are replaced by single windings. The stator winding is so arranged that both the "main" and "slip frequency" currents can circulate in it independently. The theory and characteristic of this motor are discussed.—London *Electrician*, April 16, 1920.

*Operation of Scott-Connected Transformers.*—REQUISTAN and LOUTZKY.—A theoretical and experimental investigation of the operation of three-phase to two-phase transformers in Scott connection under different conditions of unbalanced loads on the two-phase side. A series of tests were made with various degrees of unbalance on the secondary, for determination of the current distribution on the three-phase side, and corresponding vector diagrams were constructed. A special form of the Kapp transformer diagram is derived with particular reference to unbalanced Scott transformers. It is shown that very bad unbalance of voltages and currents result from an unbalance in the two-phase loads, and only when two practically equal loads of the same power factor are connected on the secondary side will a reasonably good balance be obtained.—*L'Industrie Electrique*, Feb. 10, 1920.

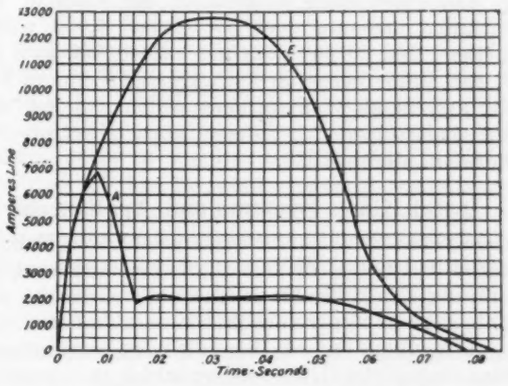
## Lamps and Lighting

*Illumination Curves Graphically Obtained from the Polar Intensity Curve.*—R. B. BÖKER.—The author describes a method for graphical determination of the floor illumination curve directly from the polar intensity distribution curve as obtained in the photometer room. The method is based upon conditions of proportionality in similar triangles. The construction is carried out by means of right angles and compasses only and appears to be adapted for practical use because of its simplicity. A similar method may be used for constructing that intensity curve which will give a certain desired illumination curve.—*Elektrotechnische Zeitschrift*, Jan. 8, 1920.

## Generation, Transmission and Distribution

*Radio Versus Wired Telephony for Power Systems.*—NUEBEL.—The radio-telephone as a means of intercommunication between power stations within a distribution system is sharply criticised from the point of view of economy, reliability and convenience, the wired telephone being said to fulfill better the requirements of a reliable intercommunicating service at a lower cost. *Elektrotechnische Zeitschrift*, Feb. 12, 1920.

*New Type of High-Speed Circuit Breaker.*—J. F. TRITLE.—The problem of correcting or protecting direct-current generators from flashover became very acute at the advent of the high-voltage direct-current railway electrification. The first high-speed breakers developed for this purpose operated at fifteen times higher speed than standard breakers. In this article a new type of high-speed breaker is described in which all mechanical




HIGH SPEED AND ORDINARY BREAKER ACTIONS

latches and triggers have been eliminated and the breaker is tripped electromagnetically instead of electromechanically. The power necessary to operate this device has been greatly reduced and the magnetic blow-out has been improved, it is said. In the diagram are shown the effects of short circuits on 2,000-kw., 3,000-volt motor-generator sets using (A) a high-speed breaker and (B) a standard breaker.—*General Electric Review*, April, 1920.

*Electrical Characteristics of Transmission Circuits—IX.*—WILLIAM NESBIT.—In this number is given the rigorous convergent series solution for the performance of long transmission lines.—*Electric Journal*, April, 1920.

*Supplying Electric Steel Furnaces Directly from Central-Station Distributing Systems.*—E. F. RUSS.—The question of rate-making in case of industries using large electric steel furnaces is touched upon, and the adaptability of the different furnace types for direct

supply from a distribution system is discussed. It is pointed out that induction furnaces, owing to their excessively low power factor and the requirement of extremely low frequencies, practically always must be provided with separate motor-generator outfits, so that the furnace circuits can be electrically separated from the supply. Arc furnaces are less detrimental to the supply power factor, their disadvantage, however, being a certain tendency to give large and sudden variations in load current. It has been suggested that special furnace transformers with large magnetic leakage might be used for smoothing out the load peaks, and various types of choke coils have also come into use for the same purpose. These and various other devices are discussed from the point of view of their effectiveness in transforming the furnace load into a more attractive proposition for the central station.— *Elektrotechnische Zeitschrift*, Jan. 15, 1920.

*Heating of Alternators and Induction Motors.*—M. BARINGOLZ.—The author derives a set of formulas permitting the calculation of the working temperature (1) of stator copper, (2) of rotor iron, (3) of rotor copper, in alternators and induction motors. The formulas are applied for the computation of the heating of certain existing machines, the results of actual tests substantiating the theory by giving very close agreements with the results of calculation.—*L'Industrie Electroque*, Nov. 25, Dec. 10 and 25, 1919.

*Rules for Electrical Machinery.*—These rules were adopted at the plenary meeting of the International Electrotechnical Commission held in London, October, 1919. The rules apply to rotating machines of which the terminal pressure does not exceed 5,000 volts, of which the rated output does not exceed 750 kva. or of which the stator cores do not exceed 50 cm. in length axially, and to all transformers which are not water-cooled.—*Publication 34, International Electrotechnical Commission*, March, 1920.

## Installations, Systems and Appliances

*Stroboscopic Slip Determination.*—M. M. BRIES.—It is pointed out that in several of the common methods of determining slip difficulty is encountered in the direct determination of slip values in the neighborhood of full load. A modification of the vibrating reed slipmeter has been devised by G. Jenson, by which it is possible to obtain accurate measurements of slips ranging from zero to 10 per cent or more. The device, as used in commercial tests, consists fundamentally of two parts, the electromagnetic vibrator and the slotted disk, arranged so as to be driven at various speeds through a set of gears from the shaft of the motor under test. —*Electric Journal*, April, 1920.

*The Glass-Bulb Mercury-Arc Rectifier in Theory and Practice.*—FRITZ KLEEBERG.—After some introductory remarks regarding the physical phenomena of the mercury-vapor arc, the author gives a very thoroughgoing mathematical discussion of the performance of a single-phase rectifier, derives expressions for secondary current and other important quantities, discusses the wave form under different load conditions and analyzes the effect of choking coils connected in the anode and the cathode leads. The theory of a polyphase rectifier, which leads to extremely complicated expressions, is treated more briefly, the resulting formulas, however, being given in full. In emphasizing, as a conclusion, the great usefulness and flexibility of the rectifier, when correctly designed and operated, the writer points out the astonishing increase in capacity to be derived from forced air-cooling of the tube. In a test on one particular type of glass-bulb rectifier designed for 350 volts and 40 amp. the maximum allowable current was raised from 40 amp. to 120 amp. owing to the use of forced air cooling. In another experiment the same bulb, also air cooled, proved capable of handling 8 amp. at 6,000 volts.—*Elektrotechnische Zeitschrift*, Feb. 19 and 26 and March 4, 1920.

*Performance of Mechanical Stokers.*—DAVID BROWNLIE.—It is the purpose of the paper to deal with mechanical firing and to present exact figures obtained by the complete investigation of the working of eighty typical Lancashire boiler plants mechanically fired. The results of the author's analysis are shown in the table:

PERFORMANCE OF MECHANICAL STOKERS

| | 80 Plants Mechanically Fired | | 250 Plants (76 per Cent Hand-Firing and 24 per Cent Mechanical Firing) | |
|---|---|---|---|---|
| | No. of Plants | Per Cent | No. of Plants | Per Cent |
| Over 80 per cent | 1 | 1.25 | 2 | 0.8 |
| 75 per cent to 80 per cent | 2 | 2.50 | 9 | 3.6 |
| 70 per cent to 75 per cent | 2 | 2.50 | 13 | 5.2 |
| 65 per cent to 70 per cent | 17 | 21.25 | 30 | 12.0 |
| 60 per cent to 65 per cent | 11 | 13.75 | 44 | 17.6 |
| 55 per cent to 60 per cent | 16 | 20.00 | 62 | 24.8 |
| 50 per cent to 55 per cent | 15 | 18.75 | 47 | 18.8 |
| Less than 50 per cent | 16 | 20.00 | 43 | 17.2 |
| | 80 | 100.00 | 250 | 100.0 |

There is little difference, he says, between the result of mechanical and hand firing with the present methods of running boiler plants.—London *Engineering*, March 26, 1920.

## Telegraphy, Telephony and Signals

*German Contributions to Theory and Practice of Vacuum-Tube Applications.*—Owing to the peculiar conditions imposed by considerations of military secrecy upon the development of triode tube applications, the literature on this subject displays some very unusual features. The lack of interchange of ideas between the belligerent nations caused a duplication of effort which led to the evolution of necessary theory on two independent although very similar lines. It is interesting to compare the means and results of the two systems. The importance of the static characteristics was early recognized on both sides, and the characteristic surface was made the foundation for an analytical treatment of the tubes. The useful device of introducing the partial derivatives of plate current with respect to grid and plate voltages due to Latour seems to have been used by Barkhausen at an early date (published in *Jahrbuch für drahtlose Telegraphie und Telephonie*, May, 1919). Barkhausen also introduces—following a private suggestion of Schottky—the notion of the "equivalent circuit" which has long been a useful tool of analysis in this country. He also gives the theory of tubes with two and three grids. The problem of oscillations with large amplitude seems to have attracted more attention in Germany than on this side. One fundamental paper (*Jahrbuch*, May, 1919) is due to Meissner, holder of one of the earliest oscillator patents, who also gives some interesting historical notes. The "dynamic characteristics," introduced by Miller, were

derived and employed for analyzing large amplitude oscillations by H. G. Möller (*Jahrbruch*, September, 1919). Rukop is the author of another paper on the theory of triode amplifiers and oscillators (*Jahrbuch*, July, 1919, errata August, 1919). All these investigators deal with power generation and lay much stress upon considerations of efficiency. The theory seems to be founded on empirical conceptions rather than mathematical developments, and the points are usually brought forth by means of schematic diagrams. The design of circuits for tube transmitters is taken up by Vos and Ziegler (*Jahrbuch*, November, 1919) of the Telefunken Company, and an article (*Jahrbuch*, September, 1919) by Ludwig Kühn deals with the development of a line of triode oscillators where the tube is said to operate in another mode than is usual. In the Kühn patents, which refer to circuits where a flywheel circuit is connected between filament and grid, it is claimed that such oscillators operate without "back-coupling," the minute amount of energy necessary for the self-excitation being transferred within the tubes from output to flywheel circuit. These and a great number of other patents in the field are reviewed by Eales (*Jahrbuch*, November, 1919; January and February, 1920). A paper by R. Jaeger (*Jahrbuch*, September, 1919) deals with the experimental testing of tubes by observing the static characteristics and contains a valuable collection of data and curves relating to German and other tubes. A graphical table is exhibited showing the emission characteristics of tungsten filaments in milliamperes per watt, temperature, life length, etc. Some practical experiences regarding evacuation, effect of different materials for constructing the tubes, etc., form the subject of a paper by E. Rückhart (*Jahrbuch*, November, 1919).

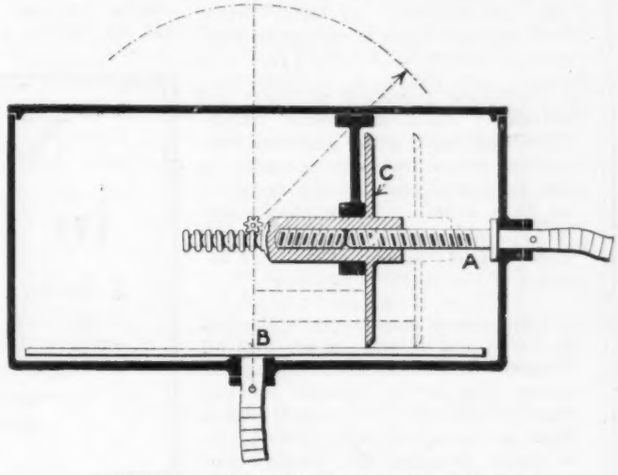
*Duplex Amplifiers.*—MARIUS LATOUR.—A description of various two-way telephone repeater circuits employing one or two triode tubes and balancing networks. —*Revue Générale d'Electricité*, March 13, 1920.

*Naval Aircraft Radio.*—T. JOHNSON, JR.—The application of radio to naval aircraft is discussed, together with the difficulties of development, standardization, installation and operation, especially under the stress of war conditions. The first operation of radio on naval aircraft and the development of the earlier types of sets are described. There is next taken up the development work carried on at the naval air station at Pensacola, Fla., and Hampton Roads, Va. A brief review of the standard types of naval aircraft is given, together with the characteristics of the radiating systems applied to them. After consideration is given to several preliminary matters in connection with transmitting apparatus, the standard transmitting equipments are described, performance data being given. Next the standard receiving equipment is taken up, and the principle, applications and performance of the naval aircraft radio compass described. In conclusion, consideration is given to the air-station telephone transmitter and its use in connection with remote-control conversation with aircraft. A recent demonstration of this application for the Secretary of the Navy is described, in which a rather remarkable record for this method of communication was established.—*Proceedings Institute of Radio Engineers*, April, 1920.

*The Story of the Insulations.*—C. E. SKINNER.—Some experiences with early forms of insulations are recited by the author, and then the characteristics of various insulating materials used at the present time are discussed in the light of developments from the early days up to the present time.—*Electric Journal*, April, 1920.

## Units, Measurements and Instruments

*A Direct-Reading Slip Meter.*—F. E. MYARD.—A sectional view of the interior of the apparatus is shown in the figure. The motor whose slip is to be measured drives by means of a flexible coupling a friction disk *B*, while the shaft *A* is driven from a small synchronous motor. The end of the shaft *A* is threaded and the disk *C*, which is rotated by the friction disk *B*, fits loosely on its threaded part. When *B* is rotating at a slightly lower speed than *B*, the disk C will evidently tend to




DEVICE FOR DIRECT MEASUREMENT OF SLIP

move along the disk *A* till its angular velocity of rotation becomes the same as that of the shaft *A*; *i.e.*, it tends to adjust itself on that diameter on the disk *B*, where the peripheral velocity equals the synchronous peripheral speed of the disk *C*. The axial displacement of the disk *C* thus is proportional to the slip and is observed by means of rack and pinion and a pointer moving over a scale, which may be graduated directly in slip.—*Revue Générale d'Electricité*, Jan. 19, 1920.

## Miscellaneous

*Vacuum and Heat Treatment of Insulating Materials.* —J. E. SHRADER.—Considerable difficulty has been experienced in determining the resistance of insulating materials under different conditions of temperature, humidity, etc. The author undertakes to show the effect of moisture removal by both vacuum and heat treatment on the conductivity of some insulating materials. Fish paper, paraffined paper, fullerboard, bakelite and bakelite micarta were investigated. The results indicate the part that moisture plays in the electrical conductivity of insulating materials. This moisture can readily be removed by vacuum and heat treatment, during which treatment its progress can be followed by electrical measurements. The author states that conductivity in this class of materials depends largely upon the amount of moisture present, by which means only can conduction take place, and that the insulating properties of a dielectric depend largely upon its tendency to absorb moisture. It was noticed that most of the materials tested became very good insulators after the treatment given. This property is not altogether permanent when the materials are again exposed in a humid atmosphere.—*Electric Journal*, April, 1920.

HEAVY buying is continuing in the electric supply field, although it is believed to be less than would take place were more stocks available. Jobbers are going a little easier on long-term buying.

FREIGHT is moving in better condition than it was a week ago, but all the shipments of the past three and four months are not yet cleaned up. At the same time, new stuff is coming through better; but the situation is far from normal and manufacturers are still hard up against the raw-material problem, while their storage space is congested with finished goods.

STEEL and porcelain products are extremely short in jobbers' hands. Here and there pipe, armored conductor, boxes, etc., have come in, but they are immediately required on back orders. Lamp stocks are broken, and shortages are beginning to be felt in rubber-covered wire because of the traffic conditions.

THE high-tension insulator market is active and shipments are getting longer. Orders for aluminum conductor are being refused because factory capacity is oversold, and a limit to supply of raw materials is in view. Demand, both foreign and domestic, is good.

WHILE notice is received that the assets of the Bluebird Manufacturing Company are double the liabilities, it is learned that a receiver has been appointed for the electric machinery company. The Langmuir gas-filled lamp patents have been upheld in the United States Courts.

HEAVY buying has been reported in the electric toy market. The public is demanding more educational and useful toys, and more attention is being paid to workmanship and material.

ALTHOUGH railroad conditions are improving somewhat in New England, one of the largest jobbing houses had a quarter of a million dollars' worth of material en route from factory to Boston stock the first of the week.

PERPETUAL right to the water resources of the Skagit River has been granted to the city of Seattle, Wash., by the United States Department of Agriculture as a source of power for the city's lighting system.

THE PROJECT for a federal Department of Public Works has been disapproved of in the referendum on the subject taken by the Chamber of Commerce of the United States at the instance of the Engineering Council.

OWING to the failure of the President to sign the water-power bill and the hasty adjournment of Congress, the measure has failed to become law up to the time of going to press, but there is a rumor that the President may still sign it and his signature be held constitutional.

ACCORDING to figures on energy production just issued by the Geological Survey for the first quarter of 1920, the average daily production from 2,800 power plants was 124,600,000 kw.-hr. in January, 119,800,000 kw.-hr. in February and 121,800,000 kw.-hr. in March.

# News in Brief

*Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry*

CLEVELAND, Ohio, has been selected as the place for the annual convention of the Illuminating Engineering Society, which will probably be held in the last week of September.

A BILL providing for the development of water power and the construction of reservoirs for better conservation, under the oversight of the state, is before the Massachusetts State Senate.

THE PRESIDENT of the National Fire Protection Association ascribed carelessness on the part of consumers as the chief cause of fires due to electricity.

A PLATFORM expressing the views of the United States Chamber of Commerce on labor relations has been submitted to a referendum of the organizations composing the national chamber.

SUGGESTED planks covering questions with a direct bearing on business prosperity were submitted to the platform committee of the national Republican convention by a committee of the National Association of Manufacturers.

CONSTRUCTION of the first unit of a plant for the fixation of atmospheric nitrogen has been commenced by the Atmospheric Nitrogen Company at Solvay, N. Y.

BY A DECISION of the Supreme Court of Missouri the right of the Cupples Station Light, Heat & Power Company to furnish electrical energy in St. Louis has been sustained.

PROF. H. A. BUMSTEAD of Yale has been elected president of the National Research Council for the year beginning July 1.

A REQUEST to the Public Utilities Commission of Idaho for a 60 per cent increase in rates for irrigation pumping brought the Idaho Power Company only a 10 per cent increase on existing business and 20 to 25 per cent on new contracts. This decision, however, is to hold for 1920 only, pending further hearings.

RAPIDLY growing load has led the Havana (Cuba) Electric Railway, Light & Power Company to plan to double its present plant capacity of 37,500 kw. in the near future.

CONSERVATION of hydraulic resources under state supervision in Massachusetts failed to pass the 1920 Legislature, which was prorogued on Saturday.

SYNCHRONOUS condensers aggregating 30,000 kva. have now been installed or authorized for early use on the New England Power Company's system. These are installed at substations in 7,500-kva. units.

AN APPROPRIATION of $125,000 for a study of power production by the Geological Survey was carried in the sundry civil bill passed before Congress adjourned.

CALIFORNIA power companies have agreed not to obligate themselves to supply any power demand of 15 hp. or more without first submitting the matter to Power Administrator Butler for determination of its necessity.

PLANS are being prepared for the establishment at Seaton Lake, in British Columbia, of a hydro-electric plant rated at 175,000 hp., to cost $12,000,000.

ELECTRIC locomotives of the type used by the Chicago, Milwaukee & St. Paul Railway will be used on the London & Northwestern, according to Sir Vincent Raven, chief mechanical engineer of the British railway systems, who with his assistants has just completed a tour over the electrified American road accompanied by the president and vice-president of that system.

DAYLIGHT saving from the second Sunday in June to the last Sunday in October has been decreed by the Chicago City Council.

A GENERAL increase in rates of nearly 20 per cent is sought by the Detroit Edison Company.

# News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

## National Manufacturers Urge Their Platform on Republican Convention

A COMMITTEE of five representatives of the National Association of Manufacturers went before the resolutions committee of the national Republican convention at Chicago this week and urged the incorporation into the platform of that party of the "platform for American industry" which was adopted by the National Association of Manufacturers at its annual convention in New York City. The manufacturers' association represents 5,400 industrial establishments employing more than 6,000,000 persons and producing about 75 per cent of the manufactured output of the United States. The members of the committee were A. B. Humphrey of the Westinghouse Air Brake Company, chairman; E. B. Leigh of the Chicago Railway Equipment Company; James A. Emery, general counsel of the National Association of Manufacturers; J. Philip Bird, general manager, and Stephen C. Mason, president of the association.

The nine planks advocated by the association may be summarized as follows: (1) Opposition to government ownership or operation of industry; (2) employers' and employees' associations to be alike subject to public authority; (3) protection of every citizen in the pursuit of lawful business or occupation; (4) repeal of the excess-profits tax and substitution of a tax on gross final sales; (5) development of a constructive plan of national transportation, interrelating railroads, waterways and hard-surfaced roads; (6) control of immigration at the source and supervision of its distribution; (7) building up of an American merchant marine privately owned and operated; (8) encouragement of foreign trade and a liberal policy toward the nation's allies in the late war; (9) generous provision for injured soldiers and for the dependents of those slain, but opposition to a general cash bonus.

## Chamber of Commerce to Hold Referendum on Labor Relations

THE United States Chamber of Commerce has submitted for a referendum vote to the 1,300 and more organizations composing its membership a number of propositions outlining the suggested attitude of the chamber on labor relations. These propositions favor freedom of contract, the open shop, state control alike of employers' and employees' organizations and, generally, a conservative policy. On labor as related to public utilities the report of the chamber says:

"In public service activities the public interest and well-being must be the paramount and controlling consideration. The power of regulation and protection exercised by the state over the corporation should properly extend to the employees in so far as may be necessary to insure the adequate, continuous and unimpaired operation of public utility service."

In accordance with this declaration of principle, two recommendations made by the Merchants' Association of New York and other business associations and reported on favorably by the chamber's committee on public utilities, of which Lewis E. Pierson is chairman, are among the propositions on which the referendum will be had. These two suggested planks are as follows:

"Strikes by employees of all public service corporations performing public service essential to the lives, health, well-being and comfort of the people should be explicitly prohibited by law."

"Suitable tribunals should be created by the law to adjudicate differences between employees of public service corporations and their employers, and the decisions of such tribunals should be final and binding upon both parties."

## Pocket Veto of Water-Power Bill "Invalid"

ON GOING to press the ELECTRICAL WORLD learns of a fine legal situation surrounding the so-called pocket veto which gives reason for belief that the water-power bill will be signed by President Wilson and become a law before this issue reaches its readers. Attorney-General Palmer, according to a statement issued Thursday morning by J. P. Tumulty, secretary to the President, had just rendered an informal opinion, to be confirmed later by a formal opinion, saying that the pocket veto is "invalid" and that the President has ten days, not counting Sunday, in which to sign legislation. This gave the President until midnight of June 11 to sign the water-power bill.

It has been customary to regard legislation in the hands of the President at the close of a Congressional session and not acted upon by the Chief Executive as of no effect. Precedent certainly, as pointed out in the editorial on pages 1351 and 1352, has given every warrant to this construction of the clause in the Constitution governing the matter.

Distinction between the end of a Congressional session and the end of a Congress, which occurs on March 4 at noon each second year, became a fine point in the issue. Precedent for executive approval was found in the case of an act signed by President Lincoln under similar circumstances, which act has been confirmed by Supreme Court decision holding it to be proper and effective as completion of the law.

Opportunity therefore seems to be afforded for President Wilson to act on the measure at any time within the ten-day period following the presentation of the bill to him, that is, on or before June 11.

Explanations that do not explain are the order in Washington with respect to the water-power bill, which the correspondents of the daily press and others

versed in political and legislative affairs at first agreed became of no effect by the failure of the President to sign it before adjournment of Congress on Saturday of last week. The nearest to an official statement in the matter was made informally by Private Secretary Tumulty, who announced that Secretary John Barton Payne of the Interior Department was vigorously opposed to the measure and then later stated that the President had received this and other bills too late to permit consideration and favorable action in view of a serious difference of opinion which had developed.

The water-power bill went to the President for signature the middle of last week. On Thursday it was referred to the Secretaries of War, the Interior and Agriculture, who by the terms of the bill would have been members of the proposed Federal Power Commission. All three Secretaries reported to the President on or before Saturday, June 5. It is definitely known that the Secretaries of Agriculture and War reported favorably, recommending that the bill be signed. However, Mr. Tumulty's statement, above referred to, clearly implies that the Secretary of the Interior's advice was against the bill. This fact is also borne out by the general belief that Secretary Payne is personally opposed to the measure. The nominal ground upon which he is supposed to have recommended a veto is that such an act would tend to destroy the national parks. Considerable credence may be given to the story on the ground that Judge Payne has been since 1911 president of the Board of South Park Commissioners of Chicago, and this activity is known to have aroused great personal interest and attention from the President.

### SEVERAL OPPOSING INFLUENCES

There is no question that several influences are still opposed to the bill. As late as the time of the conference report to the Senate, barely a week before passage, Senators Lenroot, King and Norris all took occasion to point out their objections. Two grounds for opposition were cited: First, that the proposal made the development of water power a dominating influence, even giving the right to the federal commission to interfere with navigation on important navigable streams; second, that the terms for continuing a license after the initial period were such as to give practically a perpetual lease to the original licensee.

It is probably the opposition thus voiced which leads to the common rumor in Washington, which, however, cannot be confirmed, that either Senator Lenroot or Senator King had some influence in causing the "pocket veto." In any event great surprise is expressed at every turn that the President should have declined to sign a bill of such great importance solely on the ground that possibly some measure of damage might be done to the national parks.

Two power projects had been suggested as the possible cause of Secretary Payne's objection. It had been proposed that a dam be placed near the Idaho state line, just outside of the boundaries of Yellowstone Park, in such a way that the storage of water would have been within the park territory. Another dam on the Yellowstone River, within the boundaries of the park, had also been proposed. It is quite possible that these two projects among others may have been the cause of the Secretary's opposition. However, he had refused to make any statement in the matter to the press up to the time that this was written.

The bill provides that licenses may be granted for dams, reservoirs and other projects in or upon any part of the public lands and reservations of the United States. These reservations are defined specifically to include national monuments, national parks, national forests, etc. It is evident, therefore, that one who desired to object on this ground would find some measure of plausibility for so doing in the terms of the proposed act.

In view of the fact that objection came from the Interior Department, it was questioned whether the United States Geological Survey might not also have opposed the legislation, but Dr. George Otis Smith, director of the Geological Survey, said: "It was as much a surprise to me as to any one else that the bill was not signed."

### FAILURE TO SIGN BILL CALLED ATTENTION TO AT REPUBLICAN CONVENTION

At the time that the water-power bill was left without signature at the close of the Congressional session, it was probably not realized that this legislation would become a matter of extremely great political significance in the Republican-Democratic conventions as to the achievements of the session just closed. However, the matter was deemed of such great importance by the Republicans that Senator Lodge, in his keynote speech at the Republican convention, made reference to it. The platform committee of the convention has also been urged to incorporate a plank in the platform on the matter by the American Forestry Association, which appealed to this committee in the following language:

"Water-power development is so essential in newsprint production, which affects all the newspapers of the country, and is so imperative in every economic sense, that the action of President Wilson in failing to sign the water-power bill, passed by Congress, blocks constructive legislation for increased production which the nation demands.

"The President has killed the water-power bill by his pocket veto, and his action, which stifles economic development, will cost the country dearly and it will in numerous ways aid in maintaining the high cost of living and retard increased production, so vital at this time to all our people."

Official Washington has also busied itself in the matter and not a stone was left unturned in the effort to locate some means whereby the completion of the legislation could be accomplished. It was even rumored that the Secretary of the Interior was to withdraw his objection to the bill, so that there might be no ground for the charge that the administration is hostile to it. In any event it was clear that the friends of the measure refused to lose hope in the situation, both with respect to the political aspects and the actual accomplishment of the end sought.

Late developments this week indicate additional support for the rumor that Secretary Payne opposed the legislation on the score of its possibilities in the despoliation of our parks. It is recalled that the Secretary has vigorously criticised the Director of the Reclamation Service for the latter's proposal that the Yellowstone development be made as above referred to. In this matter, the Secretary is quoted as being unalterably opposed to the projected legislation, but political exigency is often a potent influence in such cases. In this matter he is regarded as having out-Pinchot-ed the original.

## Missouri Flexible-Rate System Recommended

LEGISLATORS of Missouri were temporarily displaced by other servants of the people when the Missouri Association of Public Utilities held its fourteenth annual convention in the State Capitol at Jefferson City last week. The association members and guests were welcomed by Lieut.-Gov. Wallace Crossley, who said that the state was about to experience great industrial development and that the utilities should be equipped to supply the additional service that will be required of them.

In an interesting paper on "Merchandising of Electrical Appliances," C. E. Michel, sales manager of the Union Electric Light & Power Company, St. Louis, enumerated some of the factors which should be considered in the formulation of a set of electrical merchandising fundamentals.

Public utilities should render the best possible service under the conditions, not only because it is the duty of the company to do so, but because it is very difficult for a commission to give relief from inadequate rates when the service is not what it should be, William G. Busby, chairman of the Public Service Commission of Missouri, said in an address on the advantages of state as compared to municipal regulation.

"Large numbers of rates have been changed," said Mr. Busby, "from a fixed to a flexible basis in Missouri, and this is as it should be. Rate schedules should meet changing conditions and costs of operation, and for this reason flexible schedules are more scientific and better for both public and utility than are schedules with fixed rates."

"Utilities have been yellow," said M. H. Aylesworth, executive manager of the National Electric Light Association, in the course of an address on "Public Relations." "Central-station men have allowed agitators to denounce their companies without replying and without giving the public the correct information about the central-station business. Utility men should get out and fight those who malign them, as dishonest attacks will be prevalent until they are exposed by an honest defence. More emphasis should be placed on the service rendered, and the name of the company's bills should be changed from light bills to service bills."

That the weakness of most utility financing is because securities have been mainly sold outside of the community served was an opinion expressed by C. E. Randall of the Bank of Commerce, Springfield, Mo.

In a paper on the manufacture of raw-water ice, George E. Wells, consulting engineer of St. Louis, told the operators of small central stations how they could build up their revenue by either operating an ice plant or selling power to an ice-manufacturing company. The records of past water-power development in Missouri and the possibilities of future development were outlined in a paper presented by P. J. Sargeant of the Empire District Electric Company, Joplin, Mo.

At the closing session the association decided to affiliate with the Southwestern Division of the National Electric Light Association and with the Commercial Gas Association. The officers and committees elected to serve for the year 1920-1921 were as follows: President, L. P. Andrews, Sedalia; first vice-president, Herman Spoehrer, St. Louis; second vice-president, Col. P. J. Kealy, Kansas City; third vice-president, E. R. Locke, Mexico; secretary-treasurer, Frank D. Beardslee, St. Louis.

## Further Changes in Grounding and Station Rules of Code

FURTHER proposed changes in the rules on station equipment and on grounding service wiring have been issued by the Bureau of Standards. Comments on these proposals are requested before June 20, as it is desired to close the new edition of the code on July 1.

In the matter of guards for station equipment, the new rules require that exposed current-carrying parts of more than 7,500 volts must be protected by inclosures or barriers. For current-carrying parts between 750 volts and 7,500 volts, if inclosures or barriers are not practicable, insulating floors, platforms or mats shall be provided, and in addition permanent insulating guards shall prevent persons from touching the current-carrying parts and other live or grounded parts at the same time. For current-carrying parts between 300 volts and 750 volts, not isolated by elevation and not guarded by inclosures or barriers, insulating floors, platforms or mats shall be provided.

Low-voltage protection is now required for any motor so arranged that unexpected starting of the motor is a hazard, except those with an emergency use and where opening the circuit may cause a greater hazard. Motors with their auxiliary equipment which are liable to sparking or arcing or high temperature must be solidly inclosed if installed in a room containing explosives, inflammable gas or flyings.

Instead of one ground detector for each circuit leaving a station, the rule now provides that one or more means of ground detection must be installed in any station where circuits are not permanently grounded and that this ground detector may be applied to any such circuit extending outside the station. Equipment which does not require fuses or automatic circuit breakers (Rule 165) now includes electrically driven generators and rotary converters adequately protected from excessive load by fuses or circuit breakers in the motor leads or primary supply leads, ground conductors, field circuits, alternating-current generators protected by reactance. Arresters are now required on circuits over 7,500 volts, but not in locations where thunderstorms are infrequent at all seasons.

The rules on grounding require that, except in ice houses, packing plants, etc., where a great deal of moisture is present, no separate ground conductor shall be required for non-current-carrying part of equipment if grounded through the conduit, cable sheath or metal-raceway system of the building by means of standard lock-nuts and bushing or by a separate bond. The ground connections for non-current-carrying parts may be made to water piping at a point near the part to be protected, provided that there are no insulating joints in the pipe to prevent a good ground. It is not now necessary to shunt water meters when ground connections are made on the house side of the meter as it was according to the old rules. The ground conductor for a three-wire direct-current system shall have current capacity not less than the neutral conductor to which it is attached except when the neutral conductor is larger than No. 0000 copper wire, which is the largest size required for a ground conductor.

## I. E. S. to Meet in Cleveland at End of September

THE fourteenth annual convention of the Illuminating Engineering Society will be held in Cleveland, Ohio. Sept. 27, 28, 29 and 30 have been chosen tentatively as the dates, subject to change by the local convention committee.

It was stated at headquarters of the society this week that the State of Maryland had adopted last week the I. E. S. automobile headlight specifications and that the State of New York is revising its rules to conform to the most recent I. E. S. specifications.

## Havana Utility to Double Plant Capacity

TO TAKE care of its rapidly growing load and still have some surplus capacity available, the Havana (Cuba) Electric Railway, Light & Power Company will double its present plant capacity. The present plant has three 12,500-kw. turbines with room for a fourth. Two Westinghouse 25,000-kw. units have been ordered, one to be installed in the available space and the other to replace one of the 12,500-kw. units.

The first unit will be installed and will be in operation in 1921, and the second one will be on the line in 1922. The units are to be designed to operate at 185 lb. pressure (13 kg. per sq.cm.), 150 deg. (83 deg. C.) superheat and 28 in. (700 mm.) vacuum.

## Mr. Gompers' Belated Reply on Public's Rights

AFTER nine days' delay Samuel Gompers issued early this week a reply to the question asked him by Gov. Henry J. Allen of Kansas at their joint debate in New York City and left unanswered at that time. The question, which was printed in last week's ELECTRICAL WORLD, is reproduced below, together with Mr. Gompers' reply in full, which was prefaced with a reiteration of his claim that the query was "improper":

Q. When a dispute between capital and labor brings on a strike affecting the production or distribution of the necessaries of life, thus threatening the public peace and impairing the public health, has the public any rights in such a controversy, or is it a private war between capital and labor? If you answer the question in the affirmative, how would you protect the rights of the public? And, in addition, define for us, if you will, who had the divine right to forbid the switchmen to strike in their 'outlaw' strike. Who controls this divine right to quit work?

A. The strike is the only effective weapon by which the workers may compel consideration of just demands. It is a weapon the use of which entails serious consequence, but the question of life, which is the question at issue, is a serious question. It is much more serious to strikers than it is to Gov. Allen or members of employers' associations. The freedom of workmen in enjoyment of the right to strike means the freedom of men to make life better, safer, happier—the right of men to elevate the whole tone of society and to force abolition of abuse, injustice and oppression. There is no denial that strikes of magnitude temporarily affect the general public. Few strikes affecting production or distribution actually threaten the public peace and fewer become a menace to the public health. Strikes in which there has been a threatening of the public peace usually have been strikes in which employers, or public officials influenced by employers, have created the breach of peace by the use of thugs, armed guards and detectives. The necessity for order and obedience to laws governing conduct is impressed upon every striking organization by its leaders. The conscience of employers and of officers of the law has frequently not been so clear. Labor has no desire to cause inconvenience to the public, of which it is a part. The public has no rights which are superior to the toiler's right to live and to his right to defend himself against oppression. So far as labor is concerned, the right to strike must be and will be maintained, not only as a measure of self-defence and self-advancement, but as a measure necessary to public progress. The first step toward conservation of the rights of the public lies in a real and intelligent understanding of industrial problems by all of the people, and in the possession of that understanding the people will see that public and general welfare cannot be conserved by denying fundamental liberties to the useful members of society. The right to strike, with all its disadvantages, is an agency of progress, a buttress of manhood, of health and vigor, a promoter of public thought and education—an instrument for good, democratic in concept and essential to freedom. Its greatest justification is found in its results.

## American Engineers to Help Solve Italian Inductive Interference Problems

TO CONFER with representatives of the Italian Government and Italian engineers in connection with railway inductive interference problems in telephone and telegraph work, Charles F. Scott, professor of electrical engineering at Yale University, and L. P. Ferris, of the engineering organization of the American Telephone & Telegraph Company, sailed for Europe on Saturday, May 29. The Italian Government is planning the installation of a modern telephone network which will connect Milan, Genoa, Touraine and Rome. At the same time, owing to the fact that Italy must import all of its coal at a cost of $30 to $40 per ton extensive hydro-electric development is contemplated looking to the ultimate electrification of its railway systems.

As both Professor Scott and Mr. Ferris have been widely engaged in the study of inductive interference in the United States, they were selected to go to Italy as representatives of the Western Electric Company.

Professor Scott is well known in this field, having made early studies in Indiana and later on the New York, New Haven & Hartford Railroad and Pennsylvania Railroad systems. Mr. Ferris has been active in the California inductive interference work in this line for the past five years.

## Dr. Rosa Suggests Government Research on Utility Problems

ACTIVE co-operation by the government with public utilities in the study of the engineering involved in rendering good service to the public was urged by Dr. E. B. Rosa, chief physicist, Bureau of Standards, in an address, entitled "The Economic Importance of the Scientific Work of the Government," made on May 20 before the Washington Academy of Sciences.

"If the government would help the companies," Dr. Rosa said, "to help themselves, it would be better than an increase in rates. The government could render a service of immense usefulness and importance by studying the problems of public utilities and helping the companies to secure more efficient operation and a better public understanding of their difficulties and needs.

"If the utility's credit is impaired or it fails altogether, the community, as well as the company, suffers. It is essential, therefore, that the public should take a keen and intelligent interest in public problems, and especially in the situation which has resulted from the rising cost of labor and commodities, for which the utilities are not responsible."

## Electrical Manufacturers' Council Opens Permanent Office

THE Electrical Manufacturers' Council has opened an office in the Fifth Avenue Guaranty Building, 522 Fifth Avenue, New York. This office will serve as a headquarters for the council and its work. The council co-ordinates the work of constituent organizations of the electrical manufacturing industry, and its activities have been increased with the development of those organizations and the growth of the industry. The constituent organizations which have representatives on the council are the Associated Manufacturers of Electrical Supplies, the Electrical Manufacturers' Club and the Electric Power Club. Frederic Nicholas, as already announced in the ELECTRICAL WORLD, is executive secretary.

## Interconnection of Industrial Power Plants Discussed

IN THE absence of D. M. Petty, Bethlehem Steel Company, who was to present a paper on "Interconnection of Industrial Power Plants" at the June 8 meeting of the Pittsburgh Section, A. I. E. E., a discussion of this subject was given by several engineers of the Pittsburgh district. This discussion was led by E. C. Stone, Duquesne Light Company, who spoke of the disadvantages of industrial-plant interconnection by illustrating the value of central-station interconnection. In the case of the central station, Mr. Stone said that the interconnection was really a by-product of two well-developed nearby systems tied together by short transmission lines. Even if long lines were necessary, the load which the line itself could supply directly would justify the expense.

There were some advantages of connecting industrial plants, Mr. Stone thought, these being:

1. Reducing the ratio which the capacity of the largest motor bears to the power plant capacity feeding it.
2. More efficient use of the generating equipment through diversity of load and consequent higher load factor.
3. Pooling of emergency resources.

The advantages of interconnection, however, are not to be obtained by merely building a few transmission lines between the various power plants. On the contrary, they require an adequate engineering department and a consideration of the following points:

1. Construction of proper tower lines having sufficient capacity to provide the necessary synchronous power between plants and to handle the biggest loads that are to be interchanged.
2. Installation of switches and circuit breakers to take care of concentrated generating capacity.
3. Provision for voltage regulation.
4. Adjustment of governors on prime movers to provide proper division of load.
5. Installation of protective devices to isolate breakdown.
6. Organization of line force for maintaining lines.
7. Working out of a contract or operating agreement so that operating economics will be realized by all concerned.

J. T. Thomas, West Penn Power Company, pointed out the advantages of interconnecting several plants in different localities with special reference to the coal situation last fall.

F. C. Hanker and H. W. Smith, Westinghouse Electric & Manufacturing Company, discussed interconnection with relation to protective devices to insure continuity of operation.

John Kelly, secretary Association of Iron and Steel Electrical Engineers, pointed out the economical considerations of interconnecting industrial plants with respect to the waste heat.

R. J. Wensley and G. E. Stoltz of the Westinghouse company told how industrial plants could be interconnected. The Bethlehem Steel Company, it was learned, intended to connect its Sparrows Point (Md.) and South Bethlehem (Pa.) plants through the systems of the Pennsylvania Water & Power Company, the Consolidated Gas, Electric Light & Power Company of Baltimore and possibly the Lancaster (Pa.) company. As this interconnection involves all 25-cycle service and stations of such magnitude (ultimate rating of Sparrows Point plant will be 200,000 kw.), it was thought that this project would work.

At the annual election of officers for the Pittsburgh Section B. C. Hennison, Carnegie Institute of Technology, and H. W. Smith were chosen president and secretary respectively. New members of the executive committee are W. H. Schaefer, J. V. Peters, O. Needham and A. L. Broomwall.

## Work Started on Initial Unit of Large Nitrogen Plant

CONSTRUCTION of the first unit of a plant for the fixation of atmospheric nitrogen has been commenced near Syracuse, N. Y., by the Atmospheric Nitrogen Company, a five-million-dollar corporation formed late last year. Power for the operation of the first unit, requiring about 500 kw., will be purchased from Niagara, Lockport & Ontario Power Company.

A 60-acre site has been acquired at Solvay, outside of Syracuse, and if present plans are carried out an extensive new power-consuming industry will be built up. At the office of the General Chemical Company, which, together with the Solvay Process Company, is interested in the new plant, it was stated to a representative of the ELECTRICAL WORLD that if the present arrangement for power proves satisfactory on the first unit, the electrical load probably will be increased to fifty times the initial installation.

## Public Works Referendum Fails to Carry

ESTABLISHMENT of a federal Department of Public Works will not be advocated by the Chamber of Commerce of the United States. Results of the referendum on this subject, which was taken at the instance of the Engineering Council, were announced at the beginning of the week. The returns disclosed an especially strong sentiment against the creation of an entirely new and independent department, the vote being about four to one against it. The votes on the three propositions submitted were:

"Shall a Department of Public Works be established by the national government?" In favor, 826; against, 549; necessary to carry, 917.

"Shall a Department of Public Works be established by a suitable modification of the existing Department of the Interior, excluding therefrom the non-related bureaus and offices by change of name from the Department of the Interior to the Department of Public Works?" In favor, 675; against, 679.

"Shall a Department of Public Works be established by creation of an entirely new department?" In favor, 282; against, 992.

## British Columbia Electrical Men Meet

MORE than 200 electrical men from all branches of the industry in the Canadian Far West met at Vancouver, B. C., on May 31 and June 1 for the annual convention of the Vancouver Association of Electrical Contractors and Dealers. President E. Brettell made a welcoming address, and merchandising topics were discussed by H. B. Kirkland, vice-president American Wiremold Company; M. K. Pike, general sales manager Northern Electric Company, Montreal; O. H. Caldwell, editor *Electrical Merchandising*, New York, and W. L. Goodwin, General Electric Company, Schenectady, N. Y.

At a luncheon meeting William McNeill, assistant general manager Western Power Company, Vancouver, spoke on the reconstruction problems of the world. E. E. Walker, sales engineer British Columbia Electric Railway Company, Vancouver, opened the second day's session with a discussion of co-operation in the industry, and J. Lightbody, publicity manager of the same company, read a paper on "Co-operative Advertising."

## Geological Survey Gets $125,000 for Study of Power Production

THE sundry civil bill, which passed both houses and was signed by President Wilson last week, provides $125,000 for the Geological Survey "for a survey of power production and distribution in the United States, including a study of methods for further utilization of water power and the special investigation of the possible economy of fuel, labor and materials resulting from the use in the Boston-Washington industrial region of a comprehensive system for the generation and distribution of electricity to transportation lines and industries and the preparation of reports thereof." The Secretary of the Interior is also authorized to receive contributions to supplement this appropriation and to be expended under its provisions. The Geological Survey announces no plans as yet, but will present a program in the near future. It is probable that outside engineers will be engaged to direct all major parts of the investigation.

## Mobridge Hydro-Electric Development by South Dakota Recommended

THAT the hydro-electric development on the Missouri River four miles above Mobridge, S. D., at an estimated cost of $9,103,000 for plant and hydraulic works and $7,044,000 for primary and secondary transmission lines and substations, is feasible for the State of South Dakota but not as a private project is the conclusion of the report by Daniel W. Mead and Charles V. Seastone, consulting engineers to the Hydro-Electric Commission of the State of South Dakota. Eight units of 6,000 hp. each under a head of 30 ft. (9 m.), with 110,000 kw. transmission lines reaching Aberdeen, Redfield, Huron, Mitchell, Tripp, Yankton, Sioux Falls, Madison, Brookings, Watertown and Webster, with a step-down substation at each of these points and secondary transmission lines at 33 kv. reaching the smaller communities in the State east of the Missouri River, are proposed for the initial development. A 1,400-ft. (427-m.) dam, a power house 384 ft. (117 m.) long, a lock with 60 ft. (18.3 m.) clear width and 350 ft. (106 m.) long, and 1,200 ft. (365 m.) of earth dam with concrete core wall compose the hydraulic works. Under present development conditions only that portion of the State east of the Missouri River can be considered, and it is estimated that if the plant can be completed by 1925 and a market developed simultaneously with the plant 53,156,830 kw.-hr. can be generated for that year at a cost (including interest, depreciation and operating charges) of 2.65 cents per kilowatt-hour. By the year 1930 if a market for 85,593,500 kw.-hr. (the approximate maximum capacity of the site) can be developed, the cost would fall to 1.65 cents. Should the market not develop to these figures, the cost of generation would increase, the cost of a minimum 30,000,000 kw.-hr. output for the first year being estimated at 4.70 cents per kilowatt-hour.

If the market will warrant, an increased expenditure of $2,300,000 will permit development of the site for a 40-ft. (12.2-m.) head with a maximum capacity of 117,000,000 kw. per year, at an estimated cost of generation of 1.35 cents per kilowatt-hour. Eight possible power sites on the Missouri River, at Medicine Butte, Little Bend, Bad Hair, Mulehead, Chamberlain, Reynolds Creek, Mobridge and Big Bend, were investigated. The Mobridge site was selected for the first development because the site admits of the most economical development up to a capacity well within the estimated requirements of the State for many years.

## New England N. E. L. A. Section President on Co-operation with Contractors

"FAITH in the other fellow is the true basis of co-operation," declared President C. R. Hayes of the New England Section of the National Electric Light Association at a meeting on May 20 of the Massachusetts State Association of Electrical Contractor-Dealers at Boston.

"Both contractor and central station can be making money without injuring the other," said Mr. Hayes. "Some of you may feel that the electric light company is standing between you and success. Nothing could be further from the truth. How many electrical contractors would there be today if it were not for the optimism and energy of the central stations? You men who are successful have got to admit that you 'arrived' through your willingness to co-operate with the electric light company. You men who have been successful realize, I know, that a very fertile field has been prepared by the electric light companies.

"Good legitimate competition is not going to hurt any one. Competition in any line of business is bound to make that business prosperous. You contractors can make more money with the central station as a competitor in certain lines than you would otherwise.

"Both interests must play square. The central station, if it is planning a campaign, must let every one in on it. Have no price cutting, no haggling and no underhanded competition. Any policy of merchandising that antagonizes the local trade and causes it to talk against the utility is unprofitable. The strength of the retail electrical trade as a molder of public opinion is growing."

Other speakers who advocated co-operation were M. A. Oberlander, sales manager supply department, Western Electric Company, Inc., New York; W. F. Abely, assistant manager Western Electric Company, Inc., Boston; J. P. Coghlin, Worcester, Mass.; J. E. Wilson, secretary Massachusetts State Association, and C. S. Davis, Westinghouse Lamp Company, Boston.

## War Caused a Temporary Growth in Casualties of Public Utilities

THAT "military scorn for personal danger" evinced by returned soldiers in public utility employ was the cause for a temporary growth in its loss ratio is the view of the Utilities Mutual Insurance Company as expressed in its sixth annual report, just issued. Premiums for 1919 were $493,000, an increase over 1918 of $164,000; engineering surveys completed numbered 369 as compared with 206, and compensation cases handled totaled 1,900 as compared with 1,750. Since the organization of the company it has earned $1,485,000 in premiums and paid $345,000 in dividends, the latter amount including a dividend of $99,000, or 20 per cent, on the business of 1919.

In addition to the original purpose of the company —to write workmen's compensation insurance—the Utilities Mutual now writes public liability and automobile insurance for its member companies (exclusive of railways). It has also extended the sphere of its operation, originally confined to New York, to include Pennsylvania, New Jersey and New England, and from public utilities exclusively to include kindred industries of financial soundness.

## Taunton Municipal Plant May Purchase Energy

BY SPENDING $400,000 the municipal electric lighting plant at Taunton, Mass., can be enlarged sufficiently to handle the anticipated increase in load during the next five years, according to a recent report to Mayor Coughlin by Jackson & Moreland, consulting engineers, Boston. The report points out, however, that the cost of purchasing energy from one or more central stations within electrical range of Taunton would be about the same as the expense of local generation under favorable conditions and with good management. No recommendation as to future policy was made, the engineers believing that issue to rest exclusively with the city. The future of the plant has therefore become a live question at Taunton.

The plant generated 8,614,767 kw.-hr. in 1919, the peak being 3,220 kw. The present rating is 3,800 kw., with a temporary capacity of 5,000 kw. on overload. The fuel consumption last year was 4.8 lb. of coal per kilowatt-hour. Recently fuel oil has been used successfully. The estimated load in 1925 is 5,000 kw., and the Jackson & Moreland report states that an additional 5,000-kw. unit will be needed if the plant is to handle the business expected. The Narragansett Electric Lighting Company, Providence, R. I., the Brockton Edison company and the Eastern Massachusetts Street Railway are or shortly will be each in a position to sell energy to Taunton. The cost to the city would be about 2.25 cents to 2.5 cents per kilowatt-hour, although the railway company has made a supplementary offer of 2.08 cents per kilowatt-hour.

## M. I. T. Co-operative Plan a Proved Success

FOR the past year an interesting experiment in co-operative engineering education has been conducted by the Massachusetts Institute of Technology and the General Electric Company in which several departures from the usual plan were introduced. The class was limited to thirty students, who were chosen entirely upon the records which they had made in the equivalent of the first two years' work of the electrical engineering course at the institute. Included in this group were graduates from Yale, Harvard, Dartmouth, Princeton and the Naval Academy, besides men who had completed their first and second years solely at the institute.

The result of this year's work has been gratifying to the originators of the plan. As evidence of its approval of the work, the General Electric Company has increased the number of men who can be enrolled in this year's class to sixty. The new class will enter July 6.

## Seattle Obtains Skagit River Site

IN THE issuance of a final permit by the United States Department of Agriculture perpetual right to the immense water resources of the Skagit River has been granted to the city of Seattle, Wash., as a source of power for the city's lighting system. The permit authorizes the city to proceed with the construction of a generating power plant, which, it is estimated, will cost $7,000,000. The Gorge Creek project, which is specifically authorized in the permit, when completed, will consist of a masonry dam across the Skagit River, a 2-mile (3.2-km.) through the mountain and a 50,000-hp. plant. A part of the preliminary work on the project is already under way.

The government has agreed that the permit be enjoyed by the city without charge to the extent that the power generated by the plant is "sold to the public without profit or used by the permittee for municipal purposes."

## New Telephone for Naval Service

For months past the Navy Department has been conducting tests on a new type of hydroplane, which can be used by naval vessels for communicating with passing airplanes. The photograph shows Capt. Arthur L. Brissel of the destroyer Breckinridge and Dr. H. C. Hayes of Swarthmore College, who aided in the perfection of the instrument, listening in on the hydrophone installed on the Breckinridge.

# *Current News and Notes*

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

**Canadian Engineers Incorporating.**—Six of the Canadian provinces—Quebec, New Brunswick, Nova Scotia, Manitoba, Alberta and British Columbia—have passed laws dealing with the incorporation, registration and licensing of engineers, and in Saskatchewan and Ontario preliminary steps to the same end have been taken.

**N. E. L. A. Convention Souvenir.**—"Hydro-Electric Development," a handsomely printed and illustrated account of the company's development, "beginning with the harnessing of Snoqualmie Falls twenty years ago and leading up to the electrification of a great transcontinental road," has been issued by the Puget Sound Power & Light Company, Seattle, Wash., as a souvenir of the Pasadena convention.

**Stone & Webster Incorporated.**—The firm of Stone & Webster has been incorporated under Massachusetts laws and will henceforth be known as Stone & Webster, Inc. The partnership has consisted of Charles A. Stone, Edwin S. Webster, Russell Robb, Henry G. Bradlee, Frederick P. Royce, George O. Muhlfeld, Henry B. Sawyer, Frederick S. Pratt, Harry H. Hunt and Howard L. Rogers. Stone & Webster, Inc., will continue the business with the same personnel.

**Prompt Restoration of Service.**—A group of towns centering about Aledo, Ill., and served by the Illinois Northern Utilities Company were left without service when the interurban railroad from which the energy had been purchased decided to cease supplying it. Aledo was about 21 miles from the nearest lines of the Illinois Northern Utilities Company, but this company immediately set about extending its lines to serve the community. Wire was strung from wagons hub deep in mud while improvised rafts carried the reels of wire over swamps and swollen creeks. Notwithstanding these conditions the line was completed in forty-two days, which was considered satisfactory even by the company's patrons patiently or impatiently waiting for service.

**Great Western Power Company Asks Rate Increase.** — Presenting figures based on the estimated load for this year to show that an increase in rates is necessary to enable the company to meet current expenses, the Great Western Power Company has applied to the California Railroad Commission for a new set of rates that will enable it to earn a fair return on the money invested. The company expects an output of 112,737,560 kw.-hr. of steam-generated electrical energy in 1920 as against a steam production of 41,757,450 kw.-hr. last year, its hydro-electric production of 373,753,580 kw.-hr. in 1919 dropping probably to 281,309,580 kw.-hr. in 1920 owing to low water.

**Memorial Tablet to Edison Men.**—Thomas A. Edison unveiled a bronze memorial tablet at the Edison plant, West Orange, N. J., on May 28, in honor of men from the Edison industries in the United States who lost their lives in the world war. The ceremony was witnessed by about 5,000 employees. The tablet is placed on the south wall of the laboratory at the works. The inscription reads "World War: This tablet erected and dedicated, in memoriam, to the employees of Edison industries who gave their lives in the cause of humanity. Erected by Edison Industries Post, No. 210, American Legion, through popular subscription of employees of the Edison industries, May, 1920." About 800 Edison men served in the war, of whom about 100 lost their lives.

**Electric Drive in an English Rolling Mill.**—What the London *Electrician* asserts is the largest rolling mill in the world, that of Dorman & Long, near Redcar, England, is now driven electrically, turning out plates about 9 ft. x 100 ft. in size and ⅜ in. thick at the rate of 60 tons an hour for two hours and 30 tons an hour for the remainder of the shift. Two power stations in the plant, with a total rating of 6,750 kw., work in parallel to generate 2,750-volt, three-phase, 40-cycle energy, and this supply is supplemented with electricity from the Cleveland & Durham Electric Power Company. Transformers at each station step down the current to 440 volts. There is also a plant for lighting the works, and energy for lighting and other purposes will be transmitted to groups of houses that the company is erecting for its workpeople.

**A Mountain State System.**—The shops of the Union Pacific Railroad at Cheyenne, Wyo., the second largest on the Union Pacific's system, receive all their electrical energy from the Western Light & Power Company, the steady growth of which is reported by George E. Hayler in the *Doherty News*. The local railway also buys energy from the central station. Besides this plant in the Wyoming capital, the company has an extensive transmission plant in northern Colorado, with its main generating station at Lafayette. A 44,000-volt line forms a loop, serving Fort Collins, Greeley and other towns and returning to Lafayette, the distance covered being 119 miles. There are also about 10 miles of 13,000-volt line between Lafayette and Boulder, 22 miles of 6,600-volt line to several other towns and 17 miles of 2,200-volt branch lines. Power is supplied to the street railways at both Boulder and Fort Collins and for the Denver & Boulder Electric Railway. Irrigation at the northern end of the system and coal mining at the southern end provide steady loads.

# *Associations and Societies*

A complete Directory of Electrical Associations is printed in the first issue of each month.

**Telephone Pioneers of America.**—The seventh general meeting of the Telephone Pioneers of America will be held at Montreal, Canada, on Sept. 10 and 11.

**N. E. L. A., North Central Geographic Division.**—This body will meet in annual convention at Minneapolis, Minn., on next Wednesday and Thursday, June 16 and 17.

**National Electric Credit Association.**—This association will hold its annual meeting at the Hotel Commodore, New York City, on Thursday and Friday, June 17 and 18.

**Conference Club.**—The meeting of the Conference Club under its new form of membership which was to have been held at White Sulphur Springs, W. Va., June 17-19, has been postponed until a date in the fall to be announced later.

**A. I. and S. E. E., Pittsburgh Section.**—A paper on "Current Limit Reactance," by R. H. Keil, power engineer Jones & Laughlin Steel Company, Pittsburgh, will be read before this section at its meeting tonight.

**American Physical Society.**—The Pacific Coast Section of this society is to meet at the University of Washington, Seattle, on June 17 to 19, simultaneously with a meeting of the Pacific Division of the American Association for the Advancement of Science.

**A. I. E. E., St. Louis Section.**—On Monday evening, June 7, the Associated Engineering Societies of St. Louis held an important meeting under the auspices of the above section, B. H. Peck, general manager of the Southern Illinois Light & Power Company, giving the main address, on "Broader Applications of Engineering Methods."

**Canadian Electrical Association.**—On next Wednesday, Thursday and Friday, June 16 to 18, this association will hold its annual convention at the Ritz-Carlton Hotel, Montreal. Paul N. Lincoln will present a paper on the maximum-demand meter, and Executive Manager Aylesworth of the N. E. L. A. will address the convention. The constitution of the association is to be revised.

**I. E. S., New York Section.**—The June 17 meeting of the New York Section of the Illuminating Engineering Society will be held at Seventh Avenue and Forty-ninth Street at 8.15 p.m. It will be ladies' night and the meeting will be preceded by a dinner. The speaker of the evening will be E. L. Bragdon, technical editor of the *Motion Picture News*. Demonstrations by representatives of motion picture firms will be given.

# *Recent Court Decisions*

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

**Disallowance of Stock Issued to Promoters for Organization Expenses and of Other Hypothetical Claims.**—Stock of a power company issued to promoters under the head of compensation for preliminary and organization expenses where it did not appear that the services were of value and where the promoters were acting in a fiduciary capacity, a claim for hypothetical "compensation to conceivers" and hypothetical costs for developing the business were all properly disallowed by the Public Utilities Commission of the District of Columbia in arriving at a valuation for rate-making purposes, according to the finding of the District Supreme Court.

**Colorado Commission Without Jurisdiction in Home Rule Cities.**—According to a decision by the Supreme Court of Colorado annulling an order of the Public Utilities Commission of that state which raised the rates of a gas company against the opposition of the city of Pueblo, it has been finally determined that the commission is without jurisdiction to fix rates in home-rule cities and it cannot acquire any such jurisdiction because such cities proceed illegally in the discharge of that duty or fail to act at all. The only relief for the company in case the city fixes an unreasonable or confiscatory rate is through application to the courts. (187 P. 1026.)

**Electric Railway Deficiency Cannot Be Considered in Fixing Power Rates.**—The fact that an electric railway company has contractual relations with an electric power company and has guaranteed its obligations does not entitle it to be made a party to proceedings for the valuation of the power company's property, according to the decision of the Supreme Court of the District of Columbia sustaining the Public Utilities Commission of the District against the Potomac Electric Power Company; nor is an electric railway company entitled by reason of its ownership of the stock of an electric power company to have electric rates fixed with reference to deficiencies in the earnings of the power company.

**Electric Company Not Responsible for Injury to Trespasser.**—In a suit against the Twin State Gas & Electric Company and the city of Berlin, N. H., to recover damages for injuries to a boy playing on top of a compressor owned by the city and operated by electrical energy furnished by the company, the Supreme Court of New Hampshire found for the defendants, holding that the boy as a trespasser could not recover damages and, moreover, that an electric company is not responsible for injury from "inside wires" not owned by it where it is not shown that the company had knowledge of their being defective. In the case at issue the compressor was allowed to stand in a vacant lot, the wires connecting it with the company's lines were uninsulated, and the current had not been turned off although the work of drilling for which the apparatus had last been used had been completed twelve days before. (109 A. 839.)

**Capitalization of Free Franchises, etc., Disallowed in Fixing Rates.**—In Potomac Electric Power Company vs. Public Utilities Commission of the District of Columbia (see ELECTRICAL WORLD, March 6, page 564), the District Supreme Court held that the amount paid in stock of a power company for water rights transferred to it by an electric railway company was properly disallowed as part of the original cost of the power company's property where it appeared that both companies were controlled by the same boards of directors and there was no evidence that the water rights, of which the natural value was problematical, had been or ever would be used for the purposes of the power company. Similarly a sum added to the cost of an electric plant at the time of its absorption by another company with the same board of directors, and real estate acquired by a street railway and transferred to an electric power company, but never used except for the benefit of the railway, were properly disallowed, as were easements in the public streets in the nature of franchises which cost the company nothing.

**Water-Power Rights as Affected by Lapse of Time.**—In passing judgment in a suit brought by the Northern New York Power Corporation against the State of New York to establish water-power rights based on riparian ownership of very long standing, the Court of Claims of New York declared that where the state in constructing the original Oswego Canal in 1826 tore down the riparian owners' wing dam, constructed a new dam and appropriated the water for canal purposes, reserving to owners such portion of the water as was available through the openings which it left in the pier, the rights of the owners and of the state became fixed by lapse of time, notwithstanding absence of grant or appraisement, the only right of owners' successors being to water through such openings and to maintenance of such openings by the state. The court further found that since the construction of the new Barge Canal dam at Minetto the company has not only derived from its water-power rights all the electric horsepower (about 500 hp.) to which, under the decision just stated, it had claim, but in addition has had the use of 11,500 electric horsepower that according to law belongs to the state. (181 N. Y. S. 588.)

# *Commission Rulings*

Important decisions of various state bodies involving or affecting electric light and power utilities.

**Illinois Commission Permits Increase in Length of Span.**—On application of the Central Illinois Public Service Company, the Public Utilities Commission of Illinois has permitted the company to place its poles 350 ft. apart, the extreme distance formerly permitted having been 175 ft. This permission has reference to a new transmission line using three No. 0 B. & S. gage steel-core stranded aluminum conductors and 40-ft., 8-in.-top cedar poles set 7 ft. in the ground—a standard of construction that the commission is persuaded will give to the transmission line a factor of safety of approximately three and two-tenths.

**Discrimination by Electric Service Company Against Contractors.**—While the Maryland Public Service Commission asserts that it exercises no jurisdiction over electric companies when engaged in the work of wiring houses, it has directed the Eastern Shore Gas & Electric Company to discontinue the practice of immediately furnishing service, by virtue of an agreement with the underwriters, to new installations for which it has done the wiring, while refusing service to other applicants before the issue of the underwriters' certificate. This practice is held to be a discrimination, but the company may negotiate an agreement with other wiring contractors in order to adjust the trouble.

**Jurisdiction of Commission—Competition—Importation of Energy.**—The Grosvenordale Company, an industrial concern in North Grosvenordale, Conn., having asked the approval of the Connecticut Public Utilities Commission of the method of construction employed in a 66,000-volt transmission line running from petitioner's plant three miles to the Massachusetts boundary for the purpose of carrying energy from the New England Power Company of Massachusetts, the commission assumed jurisdiction to pass also upon the petitioner's right to construct and use such a system. This it denied on the ground that a manufacturing company without special charter rights authorizing it to do so has no power to construct an electrical transmission system across public highways and across the existing rights-of-way of other public service companies. The commission also declared that it is the legislative policy of Connecticut to prohibit within the state the purchase, sale and distribution for power purposes of electricity generated outside of the state. (See ELECTRICAL WORLD for March 6, 1920, page 568.)

# *Men of the Industry*

Changes in Personnel and Position—Biographical Notes

**Prof. Henry A. Bumstead,** director of the Sloane Physical Laboratory, Yale University, has been elected chairman of the National Research Council for the year beginning July 1. Professor Bumstead has been associated with the Yale faculty since 1893 and for three years before that was professor of Johns Hopkins University. He is a graduate of Yale and Johns Hopkins universities.

**R. Sanford Riley,** who was elected president of the Stoker Manufacturers' Association recently, is president of the Sanford Riley Stoker Company of Worcester, Mass. Mr. Riley is a graduate of the Worcester Polytechnic Institute, class of 1896. For some time after graduation Mr. Riley followed marine engineering, and in 1906 he became

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manager of the American Ship Windlass Company of Providence, R. I. While he was employed by this company he specialized on the Taylor stoker, then manufactured by it. In 1911 Mr. Riley sold out his interest in the American Ship Windlass Company, and later he organized the Sanford Riley Stoker Company, Ltd., to develop and market the Riley self-dumping underfeed stoker. He is also president of the Murphy Iron Works of Detroit.

**C. A. Nash,** manager of the new-business department of the People's Light Company, Davenport, Iowa, for the last two years, has been placed in charge of company policies in the new-business departments of the twelve gas and electric light companies operated by the United Light & Railways Company, Grand Rapids, Mich., which also operates the People's Light Company. Mr. Nash's headquarters will remain in Davenport, with the People's Light Company.

**H. P. Blodgett,** who for the past year has been superintendent of the Penobscot Bay Electric Company, Belfast, Me., has been transferred to Rockland as superintendent of that district under the new merger with the Central Maine Power Company, which acquired the Knox Power Company.

**Edward J. Cheney,** who has recently opened an office at 61 Broadway, New York City, for a general engineering and consulting practice, giving particular attention to public utility problems, including rates, appraisals, public relations, design, construction, operation and management, was for several years connected with the Public Service Commission, Second District, New York, and resigned the position of chief of its division of light, heat and power in order to take up consulting work. While with the commission he was in charge of all general and technical questions concerning gas, electric and steam heat corporations and the service rendered by them. In addition to routine testing and inspection of meters, lines, plants and service and handling all complaints and general correspondence, this work involved the making and checking of inventories and appraisals and investigations and reports in connection with service, construction, purchase, capitalization and rate questions

**W. A. Hillebrand** has recently entered the San Francisco office of the Ohio Brass Company as engineer for the company on sales matters. Mr. Hillebrand has been connected with engineering activities on the Pacific Coast for a number of years, having been engaged in instructional work at Leland Stanford Junior University and later having become head of the department of electrical engineering at the Oregon Agricultural College. More recently he was electrical engineer for the Federal Telegraph Company, where he did very important work on the design and testing of apparatus for high-voltage, high-frequency work. Mr. Hillebrand has made important contributions to the *Transactions* of the American Institute of Electrical Engineers and to various technical journals.

**John G. Callan,** who has been appointed professor of industrial management, Harvard Graduate School of Business Administration, is well known in the New England electrical field, having been at one time in the steam-turbine engineering department of the General Electric Company at Lynn, Mass., and later mechanical engineer with Arthur D. Little, Inc. He is a graduate of the Massachusetts Institute of Technology, 1896, and during the past four years has been chairman of the department of mechanical engineering, University of Wisconsin, also lecturing at Harvard on factory management.

**H. R. Woodrow,** who in 1917 was made assistant chief electrical engineer of the New York Edison Company, has resigned to take up similar work under Peter Junkersfeld with Stone & Webster. Mr. Woodrow was born in 1887 at Rock Rapids, Iowa, where he obtained his early schooling. Following his graduation from the University of Illinois in 1909, he took up a two-year post-graduate course in electrical engineering under Dr. E. J. Berg. Mr. Woodrow became associated with the New York Edison Company in 1911 as an assistant to Philip Torchio and was identified with various investigations and developments at that time. After his appointment as assistant chief electrical engineer he was closely in touch with the design and operation of the

H. R. WOODROW

various generating stations and substations of the company. Lately he has been very active in the affairs of the protective devices committee of the American Institute of Electrical Engineers and has devoted considerable time and original study to the investigation of oil-switch failures. Mr. Woodrow was identified in a consulting capacity in the design of the Trenton Falls and Washington Street stations of the Utica Gas & Electric Company, the new developments of the Municipal Gas Company, the Miller's Ford station at Dayton, the Williamsburg station of the Brooklyn Rapid Transit Company and the government plant at Nitro, W. Va.

**R. A. Mitchell** has been made treasurer of the Alabama Power Company, Birmingham, Ala., succeeding H. S. Swan, resigned. Mr. Mitchell is also vice-president of the company, which operates 1,051 miles of high-tension transmission lines served by two hydro-electric plants and two steam plants with a total rating of 140,000 kva.

**R. M. McCletchie** has been elected comptroller of the Alabama Power Company, Birmingham, Ala. Mr. McCletchie will have supervision of all accounting and finances of the company. The office of comptroller has recently been created by this company.

# Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

## Limited Supply Features Aluminum Conductor Market

DEMAND for aluminum conductors for high-tension transmission has been increasing at a good rate in the last few years. The market for this metal in non-electrical trades, however, is so large and is increasing at such a high rate that difficulty is being experienced in satisfying it. In the face of this, supply is reported as becoming rather limited.

Shipments for lengths to cover small distances, say 50 miles, are being quoted at from four to six months, while for several hundred miles the time is running up to ten months and a year. Congestion is experienced in the mills, more so in the fabricating than in the drawing processes, however. Present capacity is more than booked up, and on account of the limited stocks for electrical work orders are being refused.

While domestic demand is good, the foreign market is especially so. Large orders have recently been received for this conductor for European, Japanese and Australian properties, while inquiries, particularly from Italy, France and Scandinavian countries, have been heavy. This market has been opening up rather rapidly in view of existing installations in the States. If the material is available, a good future business is anticipated in the light of the prospect held out, when the water-power bill shall come up again next winter. While no retrenchment has been seen in the purchasing of this material by industrial power companies, reports indicate a recent holding back on the part of certain electric railway properties.

Ingot aluminum prices are strong, the market for 98-99 per cent material holding at 33 cents a pound.

## Time Studies of Production to Be Continued at Lynn

AT THE Lynn (Mass.) Works of the General Electric Company there is no intention of abandoning time study as a means of determining piece rates. Recently about 100 employees in one of the winding departments went on strike as a protest against time studies, without submitting their problem to the usual routine of the plan of representation in effect at this plant. Representatives of the men stated to Richard H. Rice, manager of the Lynn works, that their only objection was to the time study and that no other complaints existed. No complaint existed as to the fairness of the time-study checker. Mr. Rice pointed out to the men that time studies are necessary in setting new prices, determining the cost of apparatus, revising existing prices and improving methods. No revision of prices for piece work involved in this matter will be effected before July 1.

The management pointed out that if prices as set at any time are not considered fair, recourse may be had to the shop committee, which may call for a retiming at which the employees' representatives may be present. In this way, it was said, no possible injustice can result from any time study being made now or at any time. Time studies are necessary in the plant to protect the interest of employees and management alike, it was stated. Recently the general joint committee on adjustment unanimously voted that it did not consider it its function to lay down any procedure as to the methods employed in making time studies, as this has always been the function of the management, and noted the course available in case of disagreement.

Certain employees feared that beginning July 1 it was the company's intention to start the practice of wholesale price cutting in the shops, with a view to reducing piece-work costs. When this was called to the attention of the management, Mr. Rice issued a vigorous denial, stating that he could not state too emphatically that during the entire period of his managership of the works it had not been and that it is not now the policy to reduce piece-work prices merely because large earnings are made, and that the management has no complaint against those who are making large earnings by reason of large output. Whenever a time study is made a representative of the employees' shop section involved has the privilege of being present and of assisting if requested by the employee concerned.

## Tie-Up Holds Wood Pole Stocks at the Mills

THE chief problem regarding wood poles, pins and cross-arms seems to be the difficulty of obtaining shipments from the mills. One of the largest dealers in this line says he has received no cedar poles for three months. Pins are impossible to obtain, he says, and there are no stocks in the hands of dealers. Select fir cross-arms can be shipped in two weeks, but deliveries are subject to the railroads and average for all these materials from six to nine weeks. The situation is expected to clear up soon, as large surplus stocks have piled up at the mills and a plentiful supply will be available in about a month, it is thought. Chestnut poles can be obtained in two or three weeks, but the demand and supply of these is largely a local matter.

The demand for poles, pins and cross-arms is fairly strong, heavier than in the corresponding period a year ago, but not so vigorous as earlier this year, since the railroads have curtailed expenditures for the summer months.

Prices have held steady in the past few weeks. Standard locust electric light pins are quoted at $34.70 per 1,000 in lots up to 5,000. Prices for the 30-ft., 7-in. top red cedar poles are quoted as $21.95 f.o.b. New York City, $20.40 at Chicago and $22.10 at New Orleans. Forty-foot lengths, 7-in. tops, are quoted at $22.95 f.o.b. New York City, $21.40 for delivery at Chicago and $23.10 in New Orleans.

## Deliveries Slow on Electric Furnace Supplies

OWING to transportation congestion and underproduction, extended deliveries prevail at present on a majority of the mechanical and electrical items used in electric furnace construction. In some cases this applies also to raw materials used in the melting and manufacture of steel, although to a considerable extent furnace manufacturers and users who follow the material market closely are rewarded by better shipments than can be obtained on the hit-or-miss plan. In furnace material proper one of the most serious difficulties is that experienced in securing electrode deliveries. Sixty to ninety days is about the best that any electrode maker will quote. Refractories are quoted at from six to eight weeks' delivery. Slagging materials, such as fluorspar, bauxite and lime, are obtainable, but prices are rather stiff.

Electric furnace scrap is cheap compared with other types of melting scrap, such as heavy open-hearth and air-furnace melting stock, but the increasing number of elec-

tric furnaces being installed has augmented the demand so much that there is a probability that at some future time prices on this material may tend to rise. A prominent furnace maker states, however, that the price of electric furnace scrap should never closely approach the price of heavy melting stock, as in that event melting stock would be purchased.

Present prices on refractories are very unstable. Considerable research has been done of late on furnace linings, especially in brass melting equipments, and the outlook is excellent for improved life. A leading maker of electric brass furnaces pointed out to a representative of the ELECTRICAL WORLD that electrodes are abnormally high and that it appears as if there would be no relief from present prices until some competitor enters the artificial graphite field equipped with sufficient capital to do business on a large-production basis. The same situation, though less pronounced, is believed to exist in the carbon electrode market.

By and large, it is believed that prices have about reached the top in many furnace supplies. The development of the industry is progressing rapidly, especially in the multiplication of installations. One brass furnace maker recently had orders on his books for ten furnaces and stated that in less than two years his installations had grown so fast that they now exceed in daily melting tonnage the output of all competitors combined. From the delivery standpoint, the situation is declared difficult rather than alarming.

## National Electric Credit Association to Convene June 17

JUNE 17 and 18 have been set apart for the twenty-first annual meeting of the National Electrical Credit Association at the Hotel Commodore, in New York City. Besides the regular business to be attended to, topics for discussion and addresses that have been provided indicate the general interest in things fundamental to the credit side of the electrical business.

J. H. Pardee, president of the J. G. White Management Corporation; W. E. Rice of the Western Electric Company; W. Y. Conrad, vice-president of the Irving National Bank; George J. Murphy of Boston and W. H. Morton of New York, managing director of the National Association of Electrical Contractors, are among those who will address the convention. Besides, an open forum will discuss trends of the times and means of expanding the service of the association. The entertainment committee has plans for occupying the time outside of sessions.

## Market for Electric Toys Well Above That of Last Year

IN DISCUSSING the market for electric toys, manufacturers of these specialties report favorably on the demand which has arisen this spring and summer. Dealers and distributers are ordering well above their volume of last year; 50 per cent is the more general increase this season, although the range is given from a low of 25 to a high value of 100 per cent in one case. From all appearances the present-day toy is being purchased more and more with an eye toward education and utility, and a high quality of material and workmanship is demanded.

Little difficulty has been experienced in obtaining this business, manufacturers say, and it has been given out somewhat earlier in the season because of material shortages and transportation delays. Raw-material shortages are holding back production in many cases and making it impossible for some manufacturers to keep up to capacity, even though they have plenty of orders on hand. Shipping schedules are already behind, although customers are willing to take their goods earlier than they ordinarily would because of this delay in transit. Manufacturers do not agree on the outlook for raw materials this summer and fall. Some have purchased in anticipation of a shortage and are well fixed. Others are rather expecting that they will be unable to obtain raw material on time in qualities sufficient to take care of all the business that can be secured, even though freight conditions should improve. On the other hand, there is some optimism in regard to summer and fall delivery to enable schedules to be filled.

Capacities, as a rule, are sufficient to care for the demand, but at the same time one producer advises that he will have to complete an addition in order to fill his orders.

The question of price is rather easily disposed of, in that only in one case has it been reported that it will be necessary to leave it to that which shall rule at time of delivery. Definite quotations have been given in the other cases for fall delivery. No advance is anticipated, although no decline is expected this season. One manufacturer with limited stock has set a price on goods made from that stock, but advises price at time of delivery when he shall have to go into the market to replenish his stock.

## Supply of Line Hardware in an Unsatisfactory Condition

STRIKES at the steel mills are still largely responsible for the present shortage of line hardware. The freight tie-up has further handicapped steel works by curtailing their normal supplies of raw material. One dealer states that no shipments are coming in at present, and promises for future delivery range anywhere from six weeks to four months. Another company is still waiting for the fulfillment of orders given last November and December.

Existence in the field of line hardware is at present a hand-to-mouth affair, as stocks on hand are insufficient to meet current needs. This class of metal goods is particularly scarce because manufacturers are paid for such material as bolts, braces, washers, etc., on a pound basis, and there is less profit in proportion to the work concerned.

In spite of the fact that demand continues to be strong, the market has held steady since a price increase of 10 per cent about March 1. Quotations at present average approximately 6½ to 7 cents a pound.

## Bluebird Assets Shown to Be More Than Double Liabilities

AS AN aftermath to the notice of receivership concerning the Bluebird Manufacturing Company, given in these columns last week, a committee representing more than 50 per cent of the liabilities of the company has met and reported an earnest purpose on the part of the creditors to assist in the rehabilitation of the business.

Certified public accountants have completed an audit showing the assets of the company to be $2,319,191, and liabilities exclusive of capital stock to be $1,017,686. This audit also shows profits for the first three months of 1920 amounting to $197,886, before an estimated deduction of $74,000 for taxes is made.

## Big Consolidation in Washing Machine Industry

THE most recent consolidation in the electric washing machine industry has just been announced under the name of the Gillespie Eden Corporation, effective June 1. With the former Brokaw-Eden Company, which was the sales organization and which also manufactured washing machines at Alton, Ill., there have been joined the Gillespie Manufacturing Company, which makes washing machines and wringers at Lowell, Mass.; the Gillespie Motor Company, which manufactures motors at Paterson, N. J., and the Gillespie Foundry Company, which produces castings for both motors and washing machines at Paterson, N. J. This makes the Gillespie Eden Corporation a self-contained manufacturing organization, with over $4,000,000 of net assets, without additional outside assistance.

W. H. Marshall, formerly president of the American Locomotive Company, is chairman of the board of directors; T. H. Gillespie is president; E. L. Bergland, H. G. Seaber, P. J. Holdsworth and George De Laval are vice-presidents; F. J. Nash is secretary; H. S. Hart is treasurer; J. E. Halligan is comptroller, and P. V. D. Brokaw, formerly president of the Brokaw-Eden Company, is consulting director.

Among the directors are T. A. Gillespie of the T. A. Gillespie Company; Paul D. Cravath, attorney of Cravath & Henderson; Edgar Palmer, president of New Jersey Zinc Company, and Joseph B. Terbell, president of the American Brake Shoe & Foundry Company. General sales offices have been established at 23 West Forty-third Street, New York City, with branch offices at St. Louis, Denver, San Francisco and Toronto, Canada. Executive offices are at 50 Church Street, New York City.

## Langmuir Lamp Patent Sustained

IN A DECISION just handed down by Judge Hough, the United States Circuit Court of Appeals for the second circuit has sustained the Langmuir gas-filled lamp patent in the case of the General Electric Company against the Nitro-Tungsten Lamp Company. This opinion upholds that rendered by Judge Mayer on Oct. 27, 1919, the findings of which were published in these columns, page 913, issue of Oct. 25 to Nov. 8, 1919.

## Receiver for Electric Machinery Company

The federal court has appointed the Minneapolis Trust Company as receiver for the Electric Machinery Company, Minneapolis, Minn., as the result of a petition on the part of a large creditor and a stockholder of the latter company. The receiver has authority from the court to continue the business.

## Metal Market Situation

LITTLE change is noted in the copper market. Large producers are holding June copper at 19 cents, while early third quarter may be found at that price and August and September at 19.25 cents. Demand is practically nil. Even inquiries to the big producers are light. Smaller producers are making some sales around 18.50, and the outside market is selling at around 18.25 at refinery. In addition, Japanese interests are reported as reselling copper just under 18 cents, the lower figures being for ingots and ingot bars. The producers' market shows continued strength, and the feeling is that large consumers cannot hold off many more weeks. London has declined £5 to £90.

Scarcity of lead in the spot market has not been removed. While the ruling producer's price is 8.50 cents, the outside market is holding for as high as 8.90 and 9.25 cents. July figures are quoted a half cent under spot. Better supplies are reported as available from South American and Mexican fields.

### NEW YORK METAL MARKET PRICES

| | June 2 | | | June 9 | | |
|---|---|---|---|---|---|---|
| Copper | £ | s | d | £ | s | d |
| London, standard spot | 95 | 2 | 6 | 90 | 0 | 0 |
| | Cents per Pound | | | Cents per Pound | | |
| Prime Lake | 18.75 | | | 18.75 | | |
| Electrolytic | 19.00 | | | 19.00 | | |
| Casting | 17.75 | | | 17.75 | | |
| Wire base | 22.50–23.00 | | | 22.50–23.00 | | |
| Lead, trust price | 8.50 | | | 8.50 | | |
| Antimony | 8.75 | | | 8.50–8.75 | | |
| Nickel, ingot | 43.00 | | | 43.00 | | |
| Sheet zinc, f.o.b. smelter | 12.50 | | | 12.50 | | |
| Zinc, spot | 8.00 | | | 8.00 | | |
| Tin | 51.50 | | | 48.75 | | |
| Aluminum, 98 to 99 per cent | 33.00 | | | 33.00 | | |

### OLD METALS

| | Cents per Pound | Cents per Pound |
|---|---|---|
| Heavy copper and wire | 15.75 to 16.00 | 15.75 to 16.00 |
| Brass, heavy | 9.00 to 10.00 | 9.00 to 10.00 |
| Brass, light | 8.00 to 8.50 | 7.50 to 8.00 |
| Lead, heavy | 7.00 to 7.25 | 7.25 to 7.37½ |
| Zinc, old scrap | 5.00 to 5.25 | 5.00 to 5.25 |

# THE WEEK
## IN TRADE

ORDERS continue to come in to jobbers in almost unabated volume. The edge of buying is taken off, however, because of inability to satisfy demands. The trade is living in hopes of deliveries "next week." Shipments are moving in and out among manufacturers and jobbers in better condition, but in many cases orders seem to be getting further and further behind.

Some pipe and armored conductor lots have been delivered, but these stocks last only long enough to fill "hurry" necessary orders and to apply on unfilled back orders. In some cases fans have not been received and jobbers affected have had to go into the market for them. Wire is less plentiful this week in jobbers' stocks. Lamp receipts have not replenished the heavy drains made on shelves just before the April price advance.

Building is progressing in good shape, at least in so far as supplies of building materials will allow. Collections are not so bad as conditions might seem to indicate, but then jobbers have exercised great care in the last few months. Prices have been holding with little change.

### NEW YORK

Incoming deliveries have been better this week, and there is still much material being received which has been on the way for up to three and four months. At the same time fresh goods are coming through, but not in good volume. Jobbers are entering orders for various kinds of supplies which they expect to be able to fill from incoming deliveries in a week or so.

Stocks are virtually bare of most steel and porcelain goods. Carload receipts here and there of pipe, flexible armored conductor, pipe fittings, etc., give jobbers a little material to work on. Back orders are taken out, and these materials are apportioned among the balances still showing on these orders. Lamp stocks are pretty badly broken in the high-wattage B's and in the low-wattage C's, but present demand is being fairly well supplied. Cable and wall boxes are very short, and in some spots schedule material is beginning to run down. Key switches are reported in poorest supply of all the switches.

Building continues in good volume, although shortage of cement is curtailing much work. Prices show little change this week.

**Wire.**—Rubber-covered wire mill prices are holding steady and jobbers are asking from $12 to $13 for No. 14 in 1,000-ft. lots. Local stocks are not ample in all cases because shipments are not in especially good condition. Demand is good.

**Flexible Armored Conductor.**—Several good shipments have come in and jobbers are able to make fair-sized allotments on standing orders. To regular customers the holding price is rather general at $120 per 1,000 ft. for two-wire, No. 14, while orders of convenience are bringing up to $150 for either single-strip or double-strip whichever is available.

**Outlet Boxes.**—Few wall boxes or cable boxes, 3-in. sizes, are to be had. Inquiries bring the answer from jobbers that they hope to have a hundred next week.

**Conduit.**—Here and there a small amount of pipe has come in, but in general stocks are dead. Jobbers who have some are billing ½-in. black to the trade at about $96.

**Heaters.**—Delayed shipments are giving some jobbers pretty awkward stocks for this time of year. Recent cool weather, however, is moving this in a small way, but there will be quite a few to carry over the summer.

**Schedule Material.**—Strikes in brass mills are holding out poor prospects for continued shipments in shells, Edison screw parts, shade holders and snap-switch covers. Porcelain parts are pretty low.

**Lamps.**—Heavy buying just before the April price advance depleted stocks badly, and incoming deliveries since then have not been sufficient to refill the shelves. Stocks are spotty under a good demand.

**Fans.**—Jobbers receiving early shipments are in good shape, but transportation delays have kept some shelves bare. In this case jobbers have had to purchase from each other. The few warm days last week started a light movement, but cool weather again has brought a reaction.

**Heating Appliances.**—Demand is heavy and is being supplied to the extent of the short stocks at hand.

**Fuses.**—Prices of "Union" plug fuses have been advanced. Plug fuses have just advanced through a five-point drop in discount.

## CHICAGO

Amelioration of conditions in regard to rail shipments is coming about very slowly. A certain amount of freight is constantly moving, and naturally varying quantities of electrical supplies are delivered. Strenuous efforts are required to supply even approximately the demands of the trade from day to day, and the accumulation of stocks is impossible. Light construction operations are the only thing that has prevented a serious shortage in schedule material. Jobbers are receiving inquiries and orders in a steady stream, and the opinion is expressed that any falling off which may have occurred is chargeable to the rail troubles and general financial stringency rather than to any other factor.

Local building stagnation is reflected in the total of building permits for May, which were $5,660,000, against $8,925,000 in 1913 and a ten-year average of $7,570,000 for the corresponding month. For the past week permits totaled $749,300.

**Wire.**—All stocks are badly broken. It is possible to obtain immediate delivery on bare copper, dependent on the rail service, and certain fortunate jobbers have been able to maintain limited supplies of weatherproof and rubber-covered and are filling small-quantity orders out of stock. Magnet wire is unobtainable except in small quantities, and then only in certain sizes.

**Rigid Conduit.**—One-inch, ¾-in. and ½-in. are not to be had for immediate deliveries, and orders are being placed with delivery date open. Factories are reported as having a considerable supply on hand, but they are unable to get cars for shipment. Lack of building construction has prevented a serious condition in this class of material.

**Non-Metallic Flexible Conduit.**—Stock shelves are bare and delivery is quoted as ranging from eight to fifteen weeks. Factories are having difficulty in maintaining heavy production, and the outlook for an easier supply is not encouraging.

**Knobs, Tubes and Cleats.**—Local supply is practically exhausted, with only small lots and odd sizes remaining in jobbers' hands. Deliveries are very uncertain, promises ranging from three months up.

**Bell-Ringing Transformers.**—Demand is quiet, all present needs being easily met. Current price is $1.40 each.

**Annunciators, etc.**—The call for annunciators is light, with almost no demand for large sizes. Push-buttons, door openers, buzzers and similar goods are all to be found in jobbers' stocks, with demand lower than ordinarily.

**Lamps.**—Conditions are markedly improved over those of three or four weeks ago. Coal shortages which caused the shutdown of some plants have been straightened out and goods are coming into Chicago nicely. Large interests report that a few weeks of similar trend will see the re-establishment of reserve stocks on a normal basis.

**Klein Tools.**—List, which was withdrawn on this line some weeks ago, has been re-established at a considerable advance. The 5-in. diamond special plier is now $3.50 and the 8-in. $5. These prices are for current deliveries only, all orders being accepted for billing at price ruling at time of shipment. Delivery promises are long.

**Household Appliances.**—Retail sales are reported as falling off to a certain extent. On small items this is attributed to a feeling of uncertainty as to future prices on the part of the buying public, and on large items to the difficulty of financing extended payments.

## BOSTON

Orders continue to flow in faster than material does. Collections are holding up well, but deliveries show little improvement. Prices are firm, rubber-covered wire and fiber conduit trending higher. Stocks are considerably upset by irregular deliveries, and rigid conduit and knobs are short, to say nothing of small motors. Labor unrest continues in the Naugatuck Valley and at Lynn, Mass., in the electrical manufacturing field. Building contracts to date far exceed those of the corresponding period of last year. Some improvement is noted in railroad shipments in this district. Industrial plants and public utilities, however, are becoming very anxious about the large supplies of coal being shipped abroad at the expense of New England necessities.

On June 3 fire destroyed a portion of the Joseph E. Greene Company property in Boston, causing damage to the extent of about $400,000.

**Lamps.**—The long-deferred falling off in demand has begun to be in evidence, but no excess supplies of lamps are in hand. There is vigorous trade in 25-watt and 40-watt lamps and healthy activity in sign lighting. Stocks sufficient for current needs are being held by the larger manufacturers, but jobbers' stocks are rather low.

**Fiber Conduit.**—Orders are maintained on a basis which taxes distributers to the utmost, in view of railroad conditions. The removal of embargoes within the past fortnight has helped shipments materially. Prices trend upward, one large house withdrawing quotations last week in anticipation of an early advance.

**Fuses.**—The shortage of fiber tubing is cutting down production, and one manufacturer of 250-volt fuses virtually has had to suspend output for lack of this material. Stocks in general are not up to normal.

**Flexible Armored Conductor.**—Stocks are uneven, some bins being empty and others having fair supplies. Prices rule stiff at $110 per 1,000 ft. in 5,000-ft. lots. Occasional carload shipments brighten the jobber's lot.

**Non-Metallic Flexible Conduit.**—Irregular stocks are the order of the day. Little price change is evident, but some jobbers are taking orders on the price-at-delivery basis. Nominal quotations are $37.50 per 1,000 ft. for ¼-in. loom and $35 for $\frac{7}{32}$-in. in 1,000-ft. lots.

**Wire.**—Rubber-covered wire is firmer at $11.75 per 1,000 ft. in 5,000-ft. lots. Supplies are excellent in volume. Weatherproof is harder to get and is quoted on 29 cents base. Bare is on 25 cents base, and so far little difficulty has been noted in getting shipments.

**Porcelain.**—"Nail-it" knobs bring $34 per 1,000 in barrel lots, with tubes fairly plentiful and cleats scarce.

**Fans.**—Retail buying began on a moderate scale last week, but soon stopped. Jobbers advise dealers to stock up at once, in expectation of a shortage after the first torrid spell. Stocks are not large.

**Transformers.**—Distribution-type transformers are hard to get in quantity, although one jobber reports an excellent line-up to and including 15 kva. Shipments soon fade away in face of the present active demand.

**Control Equipment.**—Distributers are keeping well within motor deliveries, except on occasional pick-ups. Prices are about 10 per cent higher than in the winter, and deliveries run around two to three months. Fair local stocks of hand-operated starting apparatus up to 10 hp., and of single-phase starters up to 5 hp., are reported.

**Friction Tape.**—Local needs have been well met as a result of embargoes on outside shipments. Black tape in ¾-in. size brings 63 cents per pound in 500-lb. lots. Fair supplies are on hand here.

## ATLANTA

Improved weather conditions throughout the farming section should lessen the feeling of pessimism that has been reflected in the section for the last few weeks, although jobbers still report orders from rural districts below the prior month's average and collections are still somewhat slow.

The strike of the railway clerks of the Central of Georgia Railroad has spread to practically all other roads in the Southeast, and embargoes on shipments of freight have resulted. A number of jobbers report considerable stocks in transit and express the opinion that deliveries will continue to improve. New Orleans reports a strike of all union carpenters, numbering approximately 3,000, a walk-out which will materially slacken office building and industrial building construction in that city.

Jobbing firms report a disposition on the part of the trade to withhold orders for additional material, this being caused partly by the fact that long shipments were anticipated, thus causing orders to be placed earlier in the spring, and partly by the tightening up of the money market. No cancellations of moment are reported.

**Conduit.**—Fair shipments of conduit were received by jobbers last week and immediately split up and forwarded to contractors on back orders, tending to relieve the acute situation that existed. Shortage is still noted in sizes of ½-in. to 2-in., and sufficient back orders are on hand to absorb all shipments received for some time to come. There are no stocks in the territory, and present promises of shipment approximate four months.

**Stamped Steel Boxes.**—An increase in price of approximately 10 per cent is reported on this item, effective last week. Stocks at present are in fair shape in spite of the brisk demand, but unless goods in transit are quickly received difficulty will be experienced in meeting all orders. Shipments are quoted at from three to four weeks.

**Lock-Nuts and Bushings.**—Acute scarcity of these items is reported by all jobbers. There are practically no stocks in the territory, and manufacturers hold out no promise of relief.

**Covers and Fittings.**—A 10 per cent price advance is announced. Local stocks are reported in fair shape, with the demand holding up well.

**Flexible Armored Conductor.**—Incoming shipments are being diverted to back orders, so no stocks can be accumulated in the face of the brisk demand. Such shipments as are going out are handled strictly on an allotment basis and deliveries continue to be very poor. Price has advanced approximately 7½ per cent and present quotations are as follows: 250 ft. to 1,000 ft., two wire, No. 14, $131.40 per 1,000 ft.

**Single-Phase Motors.**—While motors in small numbers are being received from time to time, they are entirely insufficient to meet the present demand; in fact, back orders are absorbing all motors received. Shipments continue to grow in length, the latest quotation being from forty to fifty weeks.

**Armored Lamp Cord.**—This article has become active. Stocks have shrunk materially and bid fair to become exhausted in the face of very slow shipments. This is particularly true of the reinforced type. Prices are quoted as follows: Lots of 250 ft. to 1,000 ft., $4.94 per 100 ft.

**Desk Fans.**—The embargo in the East holding up shipments of fans for this section has caused a temporary shortage to develop. A number of jobbers report stocks exhausted, though shipments have been in transit for an unusual length of time.

**Washing Machines.**—No shortage of this specialty has yet developed, though jobbers are expecting difficulty in obtaining machines in sufficient quantity to meet the growing demand.

**Mangles.**—One of the largest jobbers reports his stock exhausted, owing principally, however, to difficulty in transportation. This specialty seems to be following in the footsteps of the washing machine and daily grows in popularity.

## SEATTLE—PORTLAND

There is no particular change to report over the past two weeks. Stock shortages along practically every line exist, and chances of rebuilding them are as remote as ever. Sales volumes are showing further decreases, and this applies to retailers as well as jobbers. Electrical jobbers state they have not been hurt by the building trades strike of June 1. There is considerable construction work progressing despite the walkout.

Portland jobbers report business still slow with no indications of early changes for the better. There is no heavy dropping off, but a general downward tendency. Contractors and dealers make similar reports on the situation. This naturally is reflected in a shortage of money and a demand by the contractors and dealers for an extension of time in making their payments, resulting in poorer collections by the jobbers. Jobbers report that they are tightening up on credits and would hesitate a long while before opening a new account. In fact, they undertake to discourage any new business starting at the present time.

In the retail section reports state that there is some slowing up of sales in washing machines and sweepers. Ranges remain about the same as usual. The greatest activity, retailers say, is in the line of small appliances of various sorts. A recent increase in prices of electric irons has apparently had no effect in reducing the number of sales. The volume of merchandising sales is not what it has been for the last two or three months and is appreciably lower than would naturally be expected for this season. However, conditions are still materially better from the standpoint of the retailer than a year ago, but the tendency for the past few weeks has been downward.

**Washing Machines.**—Sales are very satisfactory and the demand is far in excess of available stocks. Tentative plans for sales campaigns this summer have been dropped owing to inadequate stocks and poor shipments.

**Ironing Machines.**—Very little effort is being expended to increase sales volumes because of limited or practically exhausted stocks. Demand for domestic flat-work ironers is far in excess of available stocks.

**Meters.**—The demand of the past two weeks has showed considerable dropping off; still it is in excess of actual supply on hand.

**Insulating Tape.**—Demand is steady and stocks are very spotty. A 15 per cent increase was noted recently.

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## SAN FRANCISCO

The last of the striking shipyard workers have returned to work, ending the eight months' strike. A large number of the men had returned to work some months ago, but the additional skilled workers were needed and will incidentally help retail business. Building permits issued during May, 1920, in the three principal California cities are of the following value: Los Angeles, $3,160,000; San Francisco, $3,037,000; Oakland, $958,000. Collections are more difficult, running nearer to two months, and credit is being extended very sparingly.

**Ranges.**—Range business is spasmodic, being scattered among a number of dealers without any organized campaign. A great increase in the number of government inquiries is noticeable. There are also many heavy-duty inquiries for large ranges and bake ovens, although exceedingly slow factory deliveries are spoiling many prospects.

**Household Devices.**—This is the quiet season and dealers, as they glance at their bare shelves, are rather glad of it. With proper deliveries the small holiday business should break all records by a wide margin.

**Fixtures.**—A great increase in the number of sales of industrial reflectors is noticeable, due to the creation of modern illuminating standards. Some good government sales are reported. Improved residence lighting is also receiving attention, and a great deal of missionary work has been done by Eastern experts. Local stocks are good.

**Lamp Cord.**—Despite the number of fixtures being sold, sales are poor and large stocks have piled up on the coast.

# NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

## Electric Blasting Machines

The Davis No. 1 blaster is a new electric blasting machine manufactured by the Atlas Powder Company, Philadelphia, Pa. This machine generates its own current through the turning of its handle one turn, which is sufficient, says the manufacturer, to fire five charges. Net weight is 3¼ pounds, the outer case is heavily nickeled seamless brass tube with aluminum top and bottom plates.

ONE TURN OF HANDLE FIRES FIVE CHARGES

## Demand Meter Register

The type M-7 demand meter register is a new form of demand device manufactured by the General Electric Company and arranged for attaching directly to a standard General Electric type I-14 or D-6 watt-hour meter to convert either of them into a combined watt-hour and demand meter by simply removing the old register and substituting the new one. This device takes a form not much larger than that of a standard register and is attached to the meter in the same manner. The watt-hour meter dial remains about the same as that of the standard register. Over the upper arc of this dial is attached a small demand dial which the demand pointer traverses.

The device is of the definite-time-interval type and gives the same class of record, says the manufacturer, as that obtained from the present type M-4 demand meter. It will be furnished in 110-volt and 220-volt ratings. Standard time intervals are fifteen, thirty and sixty minutes. When shipped complete from the factory and mounted in a I-14 or D-6 watt-hour meter the combination is known as a type IM-14 or DM-6 watt-hour demand meter.

SMALL INDUCTION MOTOR DRIVES DEMAND MECHANISM

## Tension Device for Coil Winding

For high-speed winding the Belden Manufacturing Company, Twenty-third Street and Western Avenue, Chicago, is putting out a tension device fundamentally suited for small sizes of wire ranging from No. 23 to No. 40 B. & S. gage. The machine will take a spool not exceeding 6 in. in diameter, 3§ in. over all in width, with a §-in. hole. The manufacturer says that variations in tension during starting, winding and stopping are compensated for by means of a cross-head and sheave mounted between two vertical guide rods. The machine is designed to prevent the wire from tangling and breaking and to insure compactly wound coils.

## Battery Handle

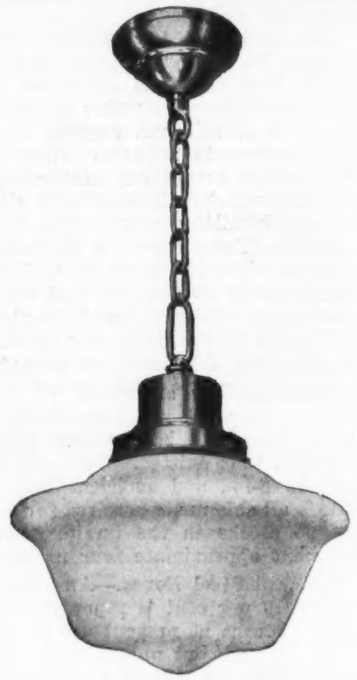
A heavily lead-coated handle for storage batteries has been put out by the Mueller Electric Company, 423 High Avenue, Cleveland, Ohio. It is of steel with reinforced sides and made so that acid should drain around the screw heads.

## Battery Gage

A voltmeter which indicates the condition of a storage battery is being distributed by Mehan-McBroom Company, 1301 Michigan Boulevard, Chicago. It is said to require about 0.01 amp. to operate.

## Totally Inclosing Unit for Commercial Lighting

The Ivanhoe "Trojan" is a new inclosing commercial lighting unit for gas-filled lamps rated at from 75 watts to 500 watts produced by the Ivanhoe-Regent Works of the General Electric Company, Cleveland, Ohio. It is a one-piece unit made in 12, 14 and 16-in. diameters, of light-density "Genco" glass. Freedom from glare is effected, the manufacturer says, by the position of the lens, the high diffusing quality of the glass and the dimensions and contour of the unit. Having no exposed inside surfaces, it is designed to be dirt-proof. Ventilation is cared for through the large radiating surface.



NO EXPOSED INNER SURFACES TO CATCH DIRT

## Auto-Transformers for Phase-Changing Service

A number of different sizes of one-to-one ratio auto-transformers, which furnish a means of deriving three phase from two phase, four wire service, and vice versa, have recently been listed as standard by the General Electric Company. These auto-transformers, type MTQ, are air-cooled, suitable for indoor or outdoor operation, and compact. They are for service on frequencies between 50 cycles and 140 cycles, 220-220 volts. The sizes selected as standard are of the following kva. output: 1, 3, 5, 7, 10, 15, 20 and 25. They cannot be used, says the manufacturer, for three-wire, two-phase service or to operate motors with interconnected phase.

FOR ADAPTING POLY-PHASE MOTORS TO EXISTING CIRCUITS

### Direct-Current Motors for Crane and Hoist Service

For severe intermittent varying speed service where heavy starting torque is required, as for cranes and hoists, the Westinghouse Electric &

FOR VARYING SPEED AND HEAVY STARTING SERVICE

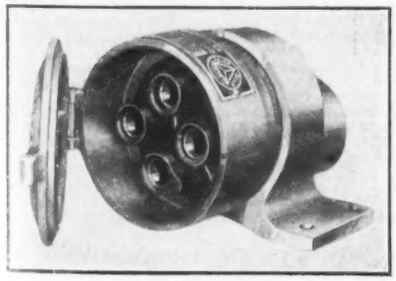
Manufacturing Company has recently brought out the type "HK" direct-current, series-wound motors. They are of compact construction, giving small over-all dimensions, light weight and great mechanical strength, the manufacturer says. Those above 3-hp. rating are equipped with commutating poles. Oil-ring lubrication is used, while a blower is placed in the rotor for ventilation. Electrically operated shoe-type brakes may be supplied. Rating is on the one-quarter-hour basis.

### Electric Alarm Clock

An alarm clock operated by dry battery in its base has been developed by the Darche Manufacturing Company, 643 West Washington Boulevard, Chicago, Ill.

### Four-Pole Receptacle

The Delta-Star Electric Company, Chicago, has developed a four-pole receptacle for two-phase service and for a three-phase motor service, where it is found necessary or desirable to

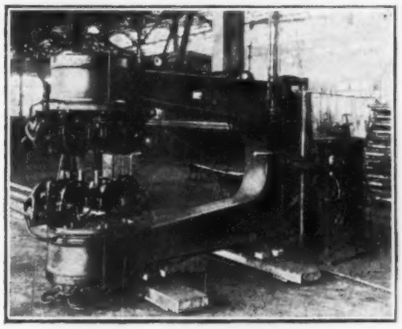


FOR USE WHERE MOTOR FRAME IS TO BE GROUNDED

ground the motor frame. It is a development of the company's three-pole type. It is used in series with switches and not for opening or closing circuits under load.

### Rotatable-Head Two-Spot Welder

A two-spot, rotatable-head, air-operated spot welder has been developed by the Federal Machine & Welder Company, Warren, Ohio. The machine is built with a cast-iron frame with a 60-in. depth of throat for capacity from two 24-gage to two 8-gage steel stock. In the upper and lower rotating heads is built a 40-kva. welding transformer with primaries in parallel and secondaries in series to permit of two spots being made at a time. The four welding points may be adjusted with distance of 3 in. to 8 in. between centers and are drawn apart 5 in. The head may be rotated through 90 deg. Hand-operated air control is applied to each point and so arranged that during the heating period 80 lb. air pressure can be regulated to apply from 300 lb. to 700 lb.

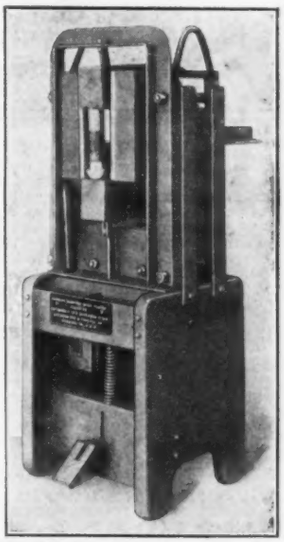


SPOT WELDS UP TO TWO 8-GAGE STEEL

pressure; welding pressure is 1,200 lb. between points. The regulating transformer supplies power to the welding transformers in eight equal voltage steps.

### Rivet Heater

The American Car & Foundry Company, New York City, has developed its line of Berwick rivet heaters so



FLEXIBLE IN FREQUENCY AND VOLTAGE

that the same machine may be used on 25 cycles or 60 cycles and 220 volts or 440 volts. It can be arranged also for 550-volt service. The heater is built in gangs to heat from one rivet to 5 rivets at a time, and is portable for use in the field.

### Instrument Cases

The Hickok Electrical Instrument Company, Cleveland, Ohio, is putting out its direct-current instruments in plain polished black bakelite cases.

## *Notes on Recent Appliances*

### Autovent Fan

The Batterman-Truitt Company, Chicago, has brought out a 36-in. autovent propeller-type ventilating fan equipped with a single-phase series compensated-type variable-speed motor.

### Dust-Proof Lighting Fixtures

A dust-proof lighting fixture for ornamental purposes is being manufactured by the Philip Panama Electric Light Company, 1627 Melrose Street, Chicago.

### Gage-Type Pressure Regulator

A new gage-type pressure regulator is being manufactured by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

### Battery Clip

The Diamond Electric Specialties Corporation, Newark, N. J., is marketing its tubular flashlights with a swivel clip for attaching purposes.

### Heater Connector Plug

The Magnus Electric Company, Inc., New York City, is marketing a plug, the "Plugall," which is said to fit all heating appliances.

### Industrial Flood-Lighting Unit

The Alexander Milburn Company, Baltimore, Md., has brought out an industrial flood-lighting unit.

### Dishwasher

The Electric Maid Company, Davenport, Iowa, has developed an electric dishwasher.

### Electric Tool Heater

A 175-watt electric heater for heating tools has been brought out by the S. U. E. Company, Boston, Mass.

### Vacuum Cleaner

A vacuum cleaner designed for heavy duty is a development of the Bissell Motor Company, Toledo, Ohio.

# MANUFACTURERS' ACTIVITIES

**Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature**

THE CHESAPEAKE IRON WORKS, Baltimore, Md., have appointed C. H. Michel as sales manager handling cranes, structural steel and general machine work. Fairbanks, Morse & Company, New York City, have been appointed sales agents for the Chesapeake crane for the territory covered by New York State, New England and Pennsylvania east of Johnstown, including Philadelphia. The Chesapeake Iron Works are building an extension to their shop, 58 ft. x 210 ft.

ROBEL & BRYANT, INC., Chicago, Ill., announce the removal of their offices from 58 East Washington Street to the Transportation Building, 608 South Dearborn Street, Chicago, effective May 1, where the firm has much larger quarters to meet the requirements of its rapidly increasing business.

THE DOYLE-DACOSTA MANUFACTURING COMPANY, Easton, Pa., is building an addition to its factory, providing approximately 5,000 sq.ft., which will enable the company to double its present capacity for the manufacture of coil windings. The company has recently begun the manufacture of armature and field coils for small electrical units.

THE PAGE STEEL & WIRE COMPANY, Grand Central Terminal Building, New York, announces the removal of its central district sales office from 29 South La Salle Street to 208 South La Salle Street, Chicago.

THE ROLLER-SMITH COMPANY, 233 Broadway, New York City, announces that it has made arrangements with the W. Montelius Price Company, 524 First Avenue, Seattle, Wash., to handle the company's line of electrical instruments, meters and circuit breakers in the States of Washington, Idaho and part of Oregon.

GEORGE C. EGGERS has resigned as district manager for the E. T. Chapin Company and is now at the head of the Eggers Pole & Supply Company, 327 South La Salle Street, Chicago. The manufacturing headquarters are at 510 Empire State Building, Spokane, Wash.

THE PYROLECTRIC INSTRUMENT COMPANY, 638 East State Street, Trenton, N. J., will continue in the pyrometer and instrument business in other quarters at the above address under the active management of H. L. Saums and W. C. Harter.

THE ERIE ELECTRICAL EQUIPMENT COMPANY, Johnstown, Pa., manufacturer of insulator pins, pipe fittings, pole-line hardware, brackets, etc., is planning to build a malleable-iron foundry, equipped with electric furnaces, to cost about $50,000. The company also contemplates increasing its capital stock from $25,000 to $100,000.

THE VICTOR ELECTRIC CORPORATION, Chicago, has a teacher regularly employed for instruction in X-ray work and gives courses in various parts of United States at different times during the year.

THE MASTER ELECTRIC COMPANY, 460 Bacon Street, Dayton, Ohio, is occupying the factory formerly used by the Burnett-Larsh Company, manufacturer of the Duro pump. The product of the Master company is fractional horse-power motors with ratings of from $\frac{1}{70}$ hp. to $\frac{1}{4}$ hp., using 110 volts and 220 volts direct current; also 32-volt motors in several sizes for farm-lighting plants, and alternating-current motors of the repulsion and induction type of various frequencies. The president is E. P. Larsh; S. A. Brown is vice-president and treasurer, and A. C. Jackson is secretary.

THE SOUTHERN ELECTRICAL EQUIPMENT COMPANY, Charlotte, N. C., expects soon to be in a position to fill orders for substation equipment, high-tension and switchboard apparatus, which it is planning to distribute through jobbers.

THE HART & HEGEMAN MANUFACTURING COMPANY, Hartford, Conn., has broken ground for the proposed new three-story addition to its plant for increased capacity.

THE INDEPENDENT ELECTRIC MACHINERY COMPANY, 1917-21 Central Street, Kansas City, Mo., has made arrangements for a two-story-and-basement office building near its present plant, in which the executive and sales offices, as well as the display room, will be contained. The present buildings will be converted into a shop and warehouse. The company is acting as distributor of the "Alamo" farm light plants.

THE SELECTED ELECTRIC APPLIANCE COMPANY, 251 Weybosset Street, Providence, R. I., has increased its capital from $60,000 to $125,000 for expansion purposes.

D. T. LAYLIN has been appointed sales manager of the Adams-Bagnall Electric Company, Cleveland, Ohio. Mr. Laylin became associated with the electrical business in 1905, when he entered the service

D. T. LAYLIN

of the Western Electric Company. After being in charge of the electrical sales and shop departments of the Strong-Carlisle-Hammond Company of Cleveland for five years, he became electrical engineer of the Standard Parts Company of Cleveland.

THE WESTINGHOUSE LAMP COMPANY will hold a conference of managers and distributers at its main plant at Bloomfield, N. J., on June 23, 24 and 25. The subjects for discussion cover a wide range in an endeavor to encourage closer co-operation between the company and its distributers.

D. B. RUSHMORE, of the Schenectady works of the General Electric Company, has been elected vice-president of the American Welding Society.

THE GENERAL ELECTRIC COMPANY, Pittsfield, Mass., is to further a plan of company aid in the formation of a home-building department under R. G. North.

THE LUMINOUS UNIT COMPANY, 2615 Washington Ave., St. Louis, Mo., has just completed a factory building which will double its space and permit of 50 per cent increase in production. A new Pittsburgh office has been opened in charge of M. B. Diedeichsen. The company now has 200 jobbers and 400 agents. It announces that Joe Chassaing is sales manager of both the Luminous Unit Company and the St. Louis Brass Manufacturing Company.

THE BLACK SWAN COMPANY, 1100 Marshall Street, Northeast, Minneapolis, Minn., has appointed L. B. Duntley, formerly general manager of the Bluebird Appliance Company, St. Louis, as sales manager. Mr. Duntley was one of the original members of the Bluebird company.

WESTINGHOUSE CHANGES. — The Westinghouse Electric & Manufacturing Company announces that H. M. Wible has been appointed manager of the rectifier section of its supply department at Newark, N. J. Mr. Wible has been with the company since 1906 and for the past eleven years has been engaged along supply lines. A new section of its supply department has been formed at Newark, N. J., to be known as the fan-motor section, commercial. W. J. Jockers, formerly of the New York office of the company, has been appointed manager of the new section. Mr. Jockers came but recently to the Westinghouse Company, but has been engaged in the electrical jobbing business for the last fourteen years, first with the Western Electric Company, then as vice-president and secretary of the Northwestern Electric Equipment Company, and later with the Royal Eastern Electrical Supply Company.

THE BESSEMER GAS ENGINE COMPANY, Grove City, Pa., announces that it has opened a new sales office in Fort Worth, Tex., and has also built a large warehouse in that city. B. L. Potter is in charge of the Fort Worth office. Another sales office has been opened at Shreveport, La., in charge of A. K. De France. The company has purchased a two-story building in Tulsa, Okla., which will be occupied as a warehouse and office. A new factory building, 240 ft. x 145 ft., will be erected at Grove City, the steel for which has already been purchased.

THE WHITE LILY MANUFACTURING COMPANY, Davenport, Iowa, has added about 12,000 sq.ft. of factory space to its plant during the past year and is now building extensions which will give an additional 50,000 sq.ft. The company has instituted a profit-sharing plan among its employees.

THE BUTTERFLY MOTOR CORPORATION, 243 West Seventeenth Street, New York, has filed notice of dissolution.

THE GREENFIELD TAP & DIE CORPORATION, Greenfield, Mass., has acquired 100 per cent of the common stock of the Lincoln Twist Drill Company of Taunton, Mass. The Taunton plant will be enlarged, as necessity requires, to meet the demands for its products. Edward Blake, Jr., formerly sales manager of the Wells Brothers Company, is vice-president and general manager of the Lincoln Twist Drill Company.

THE ELECTRIC CONTROLLER & MANUFACTURING COMPANY, 2700 East Seventy-ninth Street, Cleveland, Ohio, has opened a branch office at 49 Federal Street, Boston, Mass. The new office will be in charge of M. D. Goodman.

B. E. SUNNY, president of the Chicago Telephone Company, has been elected to fill the vacancy left in the board of directors of the Hurley Machine Company, Chicago, by the retirement of Edward N. Hurley, Jr. The other members of the board were re-elected. The company has more than 125,000 shares of common stock outstanding, and, contingent on the exercise of an option on 25,000 shares by the General Electric Company on or before Oct. 1, 1920, will have more than 150,000 shares outstanding by that date. With this option exercised less than one-third of the common stock will be held by the General Electric Company. The sales for the first four months of 1920 total $3,481,381, amounting to 61 per cent of the entire business in 1919, and show an increase of 158 per cent over the sales for the first four months of 1919.

THE CUTLER-HAMMER MANUFACTURING COMPANY, Milwaukee, Wis., has moved its Chicago offices from the People's Gas Building to the company's own building at 323 North Michigan Avenue, where it will have much larger quarters, which enable the company to carry a larger amount of stock of standard apparatus and parts. H. L. Dawson is manager of the Chicago office.

THE OHIO BRASS FOUNDRY COMPANY, Mansfield, Ohio, contemplates the construction of a malleable-brass foundry, providing additional floor space of 80,000 sq.ft.

THE GEORGE WEIDMAN ELECTRIC COMPANY, 191 Flatbush Avenue, Brooklyn, N. Y., has filed a notice of an increase in capital stock from $15,000 to $100,000.

THE SENECA WIRE & MANUFACTURING COMPANY, Fostoria, Ohio, is planning to build a plant extension, 167 ft. x 208 ft., to cost with equipment about $100,000.

THE ROME MANUFACTURING COMPANY, Railroad Street, Rome, N. Y., has filed notice of an increase in its capital stock from $850,000 to $3,000,000 for general business expansion.

THE LEHIGH VALLEY SUPPLY COMPANY, Allentown, Pa., is now established in its new quarters at Third and Oak Streets. The company will handle electric light and power plants for suburban residences and farm service as well as lighting fixtures, etc.

THE PREMIER MOTOR PRODUCTS COMPANY, Chicago, Ill., recently organized, will act as exclusive agent for the sale of the automotive products of the Premier Electric Company, Chicago. H. A. Cook, formerly advertising and general manager of the Premier Electric Company, is president of the new company, and Walter D. Graham is vice-president and treasurer.

THE EDISON LAMP WORKS of the General Electric Company at Fort Wayne, Ind., will begin work at once on the construction of a new plant on Winter Street, to cost about $500,000. Most of the building is to be two stories high, but part will be three stories. Glass bulbs are to be manufactured from the raw material. The building which was to have been erected on Holman Street will be delayed for the present.

THE EDISON ELECTRIC APPLIANCE COMPANY, Ontario, Cal., is contemplating extensions to its plant, to cost about $100,000.

## Supply Jobbers' Notes

THE ELECTRICAL EQUIPMENT COMPANY, Walla Walla, Wash., is planning to increase its capital stock from $25,000 to $75,000 for the purpose of general business expansion.

THE ALPHA ELECTRIC COMPANY, 151 West Thirtieth Street, New York City, has taken the agency for the metropolitan district for the General Railway Signal Company's washing machine, covering the territory from Trenton, N. J., to Kingston, N. Y.

THE ELECTRIC APPLIANCE COMPANY, 408 Canal Street, New Orleans, La., has acquired the property adjoining its plant, thereby increasing its floor space. The company recently celebrated its eighteenth anniversary at New Orleans, and the Chicago store is about to observe its twenty-seventh anniversary.

SWORDS BROTHERS COMPANY, Rockford, Ill., met its electrical dealers on its premises on April 23. Eighty-seven electrical dealers attented the meeting, as well as several guests in the industry who were invited to come and address the dealers. The gathering was arranged for and was under the general direction of C. A. Felker, sales manager of the company.

## Foreign Trade Notes

THE CANADIAN GENERAL ELECTRIC COMPANY, 212 King Street, West, Toronto, Ontario, Can., has awarded contract for an extension to its plant at Peterboro, Ontario, to cost, including equipment, $500,000.

ELECTRICAL EQUIPMENT FOR INDUSTRIAL PLANTS IN CHINA.—The United States Commercial attaché at Peking, China, states there will be a great demand for electrical machinery and equipment for industrial plants in China during the next few decades.

A BOHEMIAN GLOW-LAMP FACTORY.—It is reported from Prague that a glow-lamp factory on a large scale is to be established in that city by a group to which the A. E. G. and the Osrom works belong and in which American capital is said to be interested. The factory is to serve the purpose of meeting the needs of Bohemia, the adjacent states and the export trade.

DEMAND FOR ELECTRICAL MACHINERY IN RUMANIA.—There is a great demand for electric generators, motors, transformers, copper wire and cables, insulated and bare, in Rumania. Under the proposed method to finance purchases in America, the United States seller is to deliver the machines needed for the development of the Rumanian industry on credit. As security for payment the seller or the party financing the sale is to retain the right of ownership of the machines until the full purchase price, as well as the interest thereon, shall be paid.

## Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A jewelry merchant in Canada (No. 32,933) desires to purchase electric lamps, etc.

A buyer for electrical apparatus firms in Switzerland (No. 32,935) wishes to purchase brass and copper bars, rolled section brass and electrical apparatus for high voltage.

An import firm in Ceylon (No. 32,927) desires to purchase electric lamps, etc.

An electrical products dealer in Spain (No. 32,959) wishes to secure agencies for the sale of electrical materials.

Detailed specifications of motors and pumps for waterworks desired by the city of Warsaw, Poland, have been received by the Bureau of Foreign and Domestic Commerce (Reference file No. 9045).

An agency is desired by a commercial agent in the Netherlands (No. 32,889) for the sale of electrical supplies and appliances.

A merchant in Switzerland (No. 32,897) desires to secure an agency for the sale in that country and Belgium of small electric motors, electric apparatus and implements and electric household machinery.

## Trade Publications

OUTDOOR SUBSTATIONS FOR INDUSTRIAL SERVICE.—The Delta-Star Electric Company, 2433 Fulton Street, Chicago, is distributing a special publication, No. 93, illustrating its unit-type outdoor high-tension substations for industrial service.

RUBBER-INSULATED WIRE. — Bulletin No. 500-1, entitled "Standard Rubber-Insulated Wire," issued by the Standard Underground Cable Company, Pittsburgh, Pa., gives illustrations, specifications, prices, etc., of its rubber-insulated wire.

LINEAR CONDENSERS.—The International Radio Telegraph Company, 326 Broadway, New York City, is distributing bulletin No. 5, describing its series RXC-100 International linear variable condensers.

SEWING-MACHINE MOTORS. — The Chandeysson Electric Company, St. Louis, Mo., has issued a four-page pamphlet describing and illustrating the Chandeysson direct-to-shaft-connected sewing-machine motors.

ELECTRIC HOISTS.—The Shepard Electric Crane & Hoist Company, Montour Falls, N. Y., has prepared an illustrated booklet covering its electric hoists.

BALANCING APPARATUS—The Vibration Specialty Company, Philadelphia, has issued an illustrated booklet describing its "Akimoff" balancing apparatus and special machinery for the study and elimination of vibrations.

GRAPHIC RECORD SUPPLIES.—The Educational Exhibition Company, 26 Custom House Street, Providence, R. I., has issued catalog F, covering its graphic record supplies.

OIL FIRING.—Alldays & Onions, Ltd., Great Western Works, Birmingham, Eng., has issued catalog No. 464, describing its oil burners and giving diagrams and particulars of a number of conversions to liquid fuel.

AUTOMOTIVE AND DENTAL ELECTRICAL APPLIANCES.—The Anderson Electric Equipment Company, 154 Whiting Street, Chicago, is circulating catalog No. 3, covering its automotive accessories, electric lighting devices, dental and laboratory devices, etc.

HEADLIGHTS.—Engineering report No. 303 is a discussion of "Golden Glow" glass reflectors and their relation to the locomotive headlight question—a recent report sent out by the Electric Service Supplies Company, Philadelphia.

WIRE.—John A. Roebling's Sons Company has issued a 176-page price list and treatise on "Wire Rope and Wire."

LIGHTING FIXTURES. — "Perfeclite" is the title of catalog No. 4 issued by the Perfeclite Manufacturing Company, Seattle, Wash., describing and illustrating its lighting fixtures.

## New Incorporations

THE ADVANCE ELECTRIC COMPANY, Terre Haute, Ind., has been incorporated by T. W. Cook, J. M. Schoonover and W. C. Stewart. The company is capitalized at $50,000 and proposes to deal in electrical merchandise.

THE NEWLAND (N. C.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $25,000 by E. C. Guy and others.

THE PROSPECT STORAGE BATTERY & IGNITION COMPANY, Brooklyn, N. Y., has been incorporated with a capital stock of $25,000 by J. and J. Polek and A. Manly, 2421 Putnam Avenue, Brooklyn, N. Y.

THE PHILLIPS ELECTRIC COMPANY, Rochester, N. Y., has been incorporated with a capital stock of $100,000 by J. J. Phillips of Rochester. The company proposes to manufacture electric and gas fittings.

THE PHELPS SALES CORPORATION, Buffalo, N. Y., has been incorporated with a capital stock of $40,000 to manufacture lighting machinery. The incorporators are S. L. Reilly, E. J. Kuisel and S. M. Finch of Buffalo.

THE AMERICAN DISTRESS SIGNAL COMPANY, New York, N. Y., has been incorporated by F. T. Hendl, E. J. Garity and M. Scholder, 16 West 107th Street, New York City. The company is capitalized at $200,000 and proposes to manufacture fire and burglar alarm systems.

THE EDISON LIGHTBRIER CORPORATION, New York, N. Y., has been incorporated with a capital stock of $30,000 to manufacture gas and electric fixtures by W. H., S. and L. J. Shlesinger, 280 Broadway, New York City.

THE WHALEN ELECTRICAL APPLIANCE COMPANY, 802 South Grand Avenue, Los Angeles, Cal., has been organized by John M. Whalen, 1130 South Hope Street, and others. The company proposes to manufacture electrical specialties.

THE VONDER KUHLEN ELECTRIC COMPANY, Los Angeles, Cal., has been incorporated with a capital stock of $20,000 to manufacture electrical specialties. The incorporators are H. L. Vonder Kuhlen, 917 Georgia Street, and W. J. Barman.

THE ROTARY FAN SWING COMPANY, Evansville, Ind., has been incorporated with a capital stock of 200,000 by Isaac W. Crabtree, Charles N. Garrett and Travis B. Williams.

THE HIGH TENSION TRANSFORMER & EQUIPMENT COMPANY, Hoboken, N. J., has been incorporated with a capital stock of $60,000 by M. B. Cohen, S. J. Sondheim and H. A. Cone of New York.

THE LINWORTH (N. C.) MUTUAL LIGHT & POWER COMPANY has been incorporated with a capital stock of $4,000 by L. M. McGuren, J. C. Mitchell and others.

THE PHILBRIN CORPORATION, Merion, Pa., has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $1,500,000 to manufacture electric starting systems. The incorporators are: H. Boardman Hopper, Merion; Rowland S. Phillips, Kennett Square, and Firman S. Houson, Wayne, Pa.

THE GENERAL BATTERY MANUFACTURING COMPANY, Los Angeles, Cal., has been chartered with a capital stock of $150,000 to manufacture electric batteries. The incorporators are B. S. Young, Everett E. Eldridge and Arthur E. Boland.

THE VULCAN ELECTRIC COMPANY, Los Angeles, Cal., has been incorporated with a capital stock of $200,000 to manufacture electrical specialties by W. W. Sweeney, I. W. Gleason and H. A. Masac.

THE ATLAS ELECTRIC COMPANY, 101 Washington Street, Providence, R. I., has been organized to manufacture electrical specialties. Sylvester F. Argent, 192 Cedar Street, is interested in the company.

THE BRASS LIGHT FIXTURE COMPANY, New York, N. Y., has been chartered with a capital stock of $10,000 by P. and I. Pine and E. Diamond, 294 Stanton Street, New York City.

## New England States

RUTLAND, VT. — Contract has been awarded to the Northern Engineering Company, 27 School Street, Boston, Mass., by the Rutland Railway, Light & Power Company, for the construction of its new hydro-electric power plant, to cost about $500,000, including equipment.

RUTLAND, VT.—Arrangements are being made by the Vermont Hydro-Electric Corporation for the installation of a third unit at the new hydro-electric plant at Mill Village, now nearing completion.

FALL RIVER, MASS.—The construction of a one-story transformer station is contemplated by the Connecticut Mills at its plant on Bay Street.

FITCHBURG, MASS. — The Fitchburg Gas & Electric Company is having plans prepared for the construction of a one-story power plant. Charles H. Tenney Company, 201 Devonshire Street, Boston, is engineer.

NORTHBRIDGE CENTER, MASS.—The Worcester Suburban Electric Light Company of Whitinsville has been granted a franchise to extend the electric light and street-lighting system from Northbridge Center to the Grafton town line. O. E. Walcott is superintendent of the company.

ARNOLD MILLS, R. I.—At a recent meeting it was voted to petition the Blackstone Valley Gas & Electric Company to establish an electric distribution system in Arnold Mills and vicinity.

COSCOB, CONN.—Plans have been completed for improvements to the local power house of the New York, New Haven & Hartford Railroad, to increase its output about 30 per cent and thereby furnishing sufficient electricity to operate the eastern end of the railroad system.

WATERBURY, CONN.—The Connecticut Light & Power Company plans to erect an addition to its power house, to cost about $10,000.

## Middle Atlantic States

CENTRAL ISLIP, N. Y.—Bids will soon be received by E. S. Elwood, secretary of the State Hospital Commission, Albany, for the installation of new underground service connections at the Central Islip State Hospital. Plans also include the installation of two turbine-driven pumps, feed-water heater, etc.

HUDSON, N. Y.—The question of establishing a municipal electric light and power plant is under consideration.

IONA ISLAND, N. Y.—Improvements to the power plant at the local naval magazine are contemplated by the Bureau of Yards and Docks, Navy Department, Washington, D. C. The cost is estimated at about $27,000.

LANCASTER, N. Y.—According to Ernes Feyler, president of the Lancaster & Depew Electric Power & Conduit Company, it is probable that within a few months Broadway Road from Lancaster to Alden will be electrically lighted. The proposition is subject to the decision of the taxpayers and town boards of Lancaster and Alden.

NEW YORK, N. Y.—Contract has been awarded by V. Viviaudou, Inc., Times Building, to J. M. Brody, care of the National Ice & Coal Company, 103 Park Avenue, for the construction of a group of factory buildings, to cost about $1,000,000. Summerfeld & Steckler, 32 Union Square, are engineers.

POTSDAM, N. Y.—Application has been made by the St. Lawrence Transmission Company to the Public Service Commission for permission to construct and operate an electric system at Fowler, St. Lawrence County.

ROCKY POINT, L. I., N. Y.—The Radio Company of America, Woolworth Building, New York, has awarded contract to the J. G. White Engineering Company, 43 Exchange Place, for the construction of a wireless station consisting of several buildings, including a power house, to cost about $10,000,000.

WHITEHALL, N. Y.—Application has been filed by the Consolidated Light & Power Company with the State Public Service Commission for permission to proceed with the construction of an electric light plant and the erection of a local tranmission system.

YONKERS, N. Y.—The Yonkers Electric Light & Power Company has awarded contract to the Joseph Canepe Contracting Corporation, Inc., 604 South Broadway, Yonkers, for the erection of a transformer station, to cost about $200,000.

# *Construction News*

Projects, Plans, Bids and Contracts, Contemplated or Under Way

CLINTON, N. J.—The Jersey Electric Company of High Bridge has been granted permission to erect an electric transmission line from Clinton to Annandale.

IRVINGTON, N. J.—F. C. Mesa is having plans prepared for the erection of a power plant in connection with the new addition to his ammunition factory on Chancellor Avenue.

LAKEHURST, N. J.—Bids will be received at the office of the chief of the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 21 (Specification 4128), for the erection of a power house and the installation of equipment at the local navy yard, to cost about $400,000. Further information may be obtained on application to the above address.

MORRISTOWN, N. J.—The Board of Public Utility Commissioners has granted the United Electric Company of Boonton and Morristown authority to dispose of its property to the Morris & Somerset Electric Company of Morristown for $350,000. The new owner has been granted permission to issue $200,000 in stock and $350,000 in notes, to purchase and make extensive improvements to the property.

HARRISBURG, PA. — Application has been made to the Public Service Commission for the merger of eight electric and gas companies under the name of the Pennsylvania Light & Power Company. The proposed new company contemplates the expenditure of about $5,000,000 for new electric generating machinery and new transmission lines.

HARRISBURG, PA.—The Public Service Commission is considering the following applications for bond and stock issues for proposed extensions to electric light plants and systems: Pennsylvania Lighting Company, bonds, $558,000; Lykens Valley Light & Power Company, Philadelphia, bonds, $73,000; Pennsylvania Utilities Company, Easton, bonds, $137,000; Penn Central Power & Transmission Company, Altoona, bonds, $150,000; Penn Central Light & Power Company, Altoona, bonds, $251,000; Scranton Electric Company, Scranton, bonds, $190,000; Metropolitan Edison Company, bonds, $50,000; Wilkes-Barre Connecting Railroad, Wilkes-Barre, stock, $82,000, and bonds, $16,000; Reading Transit & Light Company, Reading, bonds, $50,000.

PHILADELPHIA, PA.—Bids will be received by James T. Cortelyou, director, Room 215, City Hall, Philadelphia, Pa., until June 18, for the following: For furnishing two boiler-feed pumps; 13,000 ft., 50-pair, and 11,000 ft. 15-pair, all No. 14 gage paper and lead cable; forty dynamotors; improvements and extensions to the fire alarm central office equipment; 100 patrol signal boxes; one dynamotor frame; one storage battery and equipment; 3,500 ft. twenty-conductor, 6,000 ft. fifteen-conductor, 4,000 ft. four-conductor, all No. 14 gage rubber and lead cable; for the installation of 2,000 ft. of four-way terra-cotta conduit, etc. Specifications and proposal blanks may be obtained at Room 616, City Hall.

PHILADELPHIA, PA. — The General Electric Company of Schenectady, N. Y., contemplates the construction of an electrical plant in Philadelphia, to cost about $10,000,000. A. Vogel, at the Schenectady works, is assistant superintendent of grounds and buildings.

PHILADELPHIA, PA.—The City Council has approved an issue of $4,000,000 in bonds, the proceeds to be used for equipment for the Frankford elevated railway line. W. S. Twining, director of the Department of City Transit, is in charge.

BALTIMORE, MD.—The Chesapeake & Potomac Telephone Company, 5 Light Street, will soon award contract for the erection of a telephone exchange, to cost about $250,000. McKenzie, Vorhees & Gmeline, 1123 Broadway, New York, N. Y., are architects.

LAUREL, MD.—The Maryland Motors Corporation, 631 Munsey Building, Baltimore, contemplates the erection of a new hydro-electric plant on the Patuent River, to cost about $120,000. T. B. Webster, 631 Munsey Building, is engineer.

OAKLAND, MD.—The Town Council has petitioned the State Legislature for authority to appropriate $50,000, the proceeds to be used for lighting purposes.

QUEENSTOWN, MD.—A bill has been introduced into the State Legislature authorizing the Commissioners of Queen Anne's County to construct and operate an electric light and power plant in Queenstown.

SNOW HILL, MD.—The Council has appealed to the State Legislature for authority to purchase and operate the local electric light plant, owned by the Snow Hill Electric Light & Power Company.

THURMONT, MD.—A bill has been introduced into the State Legislature authorizing the Commissioners of Frederick County to make arrangements to provide funds for improvements to the municipal electric light and power plant in Thurmont.

CHARLESTON, W. VA.—Electrification of its plant and the installation of a 250-kw. generator unit is planned by the Brush Creek Coal Company.

FAIRMONT, W. VA.—The Monongahela Valley Traction Company has been granted a permit for the erection of a 22,000-volt electric transmission line in Monongahela County.

BEDFORD, VA.—Plans are being prepared by W. C. Whitner & Company, engineers, Virginia Railway & Power Building, Richmond, for the construction of a new municipal hydro-electrc plant and dam, to cost about $100,000.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Until June 18, South Charleston, W. Va., Schedule 6356, electric hoists; Schedule 6357, electric furnace control panels. Until June 22, Washington, D. C., Schedule 6289, electric cable. Until June 25, Boston, Mass., Schedule 6349, electric hoists. Mare Island, Cal., Schedule 6299, electric insulators. Applications for proposals should designate the schedule desired by number.

WASHINGTON, D. C.—Bids will be received at the office of the Chief of Engineers, United States Army, Washington, D. C., advertisement 41, for furnishing electric power cable. For further information apply to above address.

WASHINGTON, D. C.—Contracts have been awarded by the Potomac Electric Company, 231 Fourteenth Street, to P. F. Gormley Company, Union Trust Building, and to S. R. Harris, 710 Fourteenth Street, for the construction of two substations.

## North Central States

DETROIT, MICH.—Bids have been rereceived by Smith, Hinchman & Grylls, Washington Arcade, for the erection of a factory addition, 79 ft. x 532 ft. Lighting equipment for central-station supply, provisions for motors, etc., will be required.

MARCELLUS, MICH.—The question of issuing $23,000 in bonds for the installation of two new generating units in the municipal electric light plant to provide for twenty-four hour service will soon be submitted to the voters.

TRAVERSE CITY, MICH.—The construction of a steam-operated electric light plant, to cost about $75,000, is contemplated.

CANTON, OHIO.—Bids will be received by Mr. Lane of the Board of Education until June 19 for the erection of a high school, to cost about $1,000,000. Thayer & Johnson, 5716 Euclid Avenue, Cleveland, are architects.

CLEVELAND, OHIO.—The erection of a market house, garage, ice place, etc., on East 105th Street and Euclid Avenue, to cost about $1,500,000, is contemplated. Electric wiring, motors and electric elevators will be installed. G. H. Greenberg, attorney, Society for Savings Building, is in charge.

COLUMBUS, OHIO.—The City Council has been urged to authorize a survey of the municipal electric light plant for the purpose of determining the defects of the plant and its system of operation.

DAYTON, OHIO.—The erection of a central station and the installation of a new signal system for the fire department, to cost about $180,000, is contemplated. George Baker is city engineer.

LIMA, OHIO.—Work has been started by the Ohio Railway Company on the erection of an electric transmission line between Lima and Toledo, to carry electric energy from the plant of the Doherty organization. Other improvements, to be started at once, have been planned by the company. The total cost is estimated at about $185,000.

MIDDLETOWN, OHIO.—A project is being promoted by the Chamber of Commerce for extension to the ornamental street-lighting system in Middletown.

FULTON, KY.—Plans are under cousideration for the extension of electric light service to all farmers along the route between Fulton and Hickman, and possibly to the town of Cayce, which is a midway point. The cost of the improvements is estimated at about $90,000.

INDIANAPOLIS, IND.—An appropriation of $650,000 has been made for the installation of a new power plant at the Arsenal Technical High School.

MARION, IND.—The installation of a "white way" street-lighting system in the principal streets of the village is being planned by the Village Council.

CHICAGO, ILL.—The University of Chicago contemplates the construction of a power plant on Ellis Avenue, to cost about $1,000,000. Holabird & Roche, 104 South Michigan Avenue, are architects.

MARION, ILL.—The installation of an ornamental street-lighting system, to cost about $54,000, has been approved by the City Commission.

EAGLE RIVER, WIS.—Bonds to the amount of $17,000 have been voted for improvements to the electric light and water plant.

HARTFORD, WIS.—The Hartford-Rubicon Electric Company, recently organized, has purchased the poles and lines of the Hartford Electric Company on Pleasant Hill, and plans extensions and improvements to cost about $6,000.

NEW LONDON, WIS.—The City Council has voted to enter into contract with the Huron Valley Light & Power Company of Shelby, for a period of five years, to supply electricity to New London. It is probable that a transmission line will be erected midway between Plymouth and Shelby, coming through Shiloh, Greenwich and up to New London.

RUTLAND, WIS.—The Interurban Lighting Company has been recently incorporated with a capital of $10,000 for the purpose of furnishing electric light and power to the town of Rutland.

ARGYLE, MINN.—Bids will be received by E. A. Brekke, village recorder, until June 14 for improvements to the electric distribution system.

BENSON, MINN.—Bids will be received by W. E. Skinner, engineer, 542 Lumber Exchange Building, Minneapolis, until June 15, for improvements to the municipal electric light plant, including the installation of boilers, stokers, etc.

BRECKENRIDGE, MINN.—At a special election to be held June 15 a proposal to issue $15,000 in bonds for the erection of a new municipal electric light plant will be submitted to the voters.

MAQUOKETA, IOWA. — Authority has been granted to the Iowa Electric Company by the Board of Supervisors of Jackson County to use the public highway for extensions to the company's transmission lines north from Maquoketa to Andrew.

DE SMET, S. D.—A bond issue for the establishment of a telephone system in De Smet is contemplated.

ROCKHAM, S. D.—The erection of an electric power plant is contemplated by the city officials.

LINCOLN, NEB.—Bonds to the amount of $300,000 have been voted for improvements to the electric light system. T. H. Berg is city clerk.

WAKEFIELD, NEB.—The installation of a new 100-hp. engine and a generator in the municipal electric light plant is contemplated.

## Southern States

WINSTON-SALEM, N. C.—Contracts will soon be awarded by the Memorial Hospital for the construction of several hospital buildings, including power house, to cost about $800,000. C. B. Keen, 1218 Chestnut Street, Philadelphia, Pa., is architect.

COLUMBIA, S. C.—Plans are being prepared for improvements and extensions to the electric street-lighting system, to cost about $20,000. W. H. Harth is city electrician.

PARIS ISLAND, S. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 21, for improvements to the power plant at the local navy yard, to include the provision and installation of one 300-kva. turbo-alternator; one 25-kw. exciter; alterations to building and the removal and relocation of present equipment to provide for the new arrangement of machinery. A deposit of $20 is required for drawings and Specification 4211, which may be obtained on application to the above address or the Post Commander, Marine Barracks, Paris Island, S. C.

DAVISBORO, GA.—An issue of $15,000 in bonds is under consideration for the erection of a municipal electric light and power plant.

EASTMAN, GA.—C. F. Wagner of the J. B. McCrary Company, of Atlanta, has been appointed by the city authorities to make an estimate of the cost to install a municipal electric light plant at Eastman.

LOUISVILLE, GA.—The municipal electric light plant and water pumping station, recently destroyed by fire, causing a loss of $20,000, will be rebuilt.

MORRISTOWN, TENN.—Extensions to the electric light system, to cost about $30,000, are planned. F. W. Donaldson is Mayor.

JACKSON, ALA.—The Bolen Brothers contemplate the establishment of a local electric light plant.

MUSCLE SHOALS, ALA.—Bids will be received at the office of the constructing quartermaster, U. S. Nitrate Plant 2, Muscle Shoals, until June 21, for the erection of a 4-mile transmission line between plants 1 and 2. Plans and specifications may be obtained on application to the above office.

CONWAY, ARK.—Improvements to the electric light and water systems, to cost about $12,000, are under consideration.

MONROE, LA.—The Petticord Motor Supply Company contemplates the construction of a plant and the installation of electrically driven equipment for the manufacture of automobile accessories. T. H. Petticord is president and general manager.

MARNE, OKLA.—Bonds have been voted for the construction of a municipal electric light plant, to cost about $20,000.

FORT WORTH, TEX.—The Southwestern Telegraph & Telephone Company contemplates an expenditure of $500,000 for additions and extensions to its telephone system.

LA PORTE, TEX.—The erection of a power house and water tower at St. Mary's College, is contemplated.

## Pacific and Mountain States

NEWPORT, WASH. — Application has been made by the Calispell Light & Power Company for permission to divert 20-sec.ft. of water from the north fork of Calispell Creek for power purposes.

HOOD RIVER, ORE.—The City Council contemplates the installation of an electric street-lighting system.

ROSEBURG, ORE.—At a recent election bonds to the amount of $500,000 were voted for the erection of an electric light and power plant, to be located at Whistlers Bend, 12 miles east of Roseburg.

SALEM, ORE. — A project has been started by business men of Union and Grant counties for the purpose of securing $100,000 toward the construction of a private power plant to be leased to the Eastern Oregon Power Company of Baker. The proposed generating plant would cost $200,000, half of which would be furnished by the Eastern Oregon Power Company.

SALEM, ORE. — The Oregon Electric Company is planning improvements to its plant, to cost about $10,000.

COVELO, CAL.—Application has been made to the State Water Commission by S. E. Getlis for the diversion of 189 sec.-ft. from the north fork of the Eel River for power purposes. The amount of water to be stored aggregates 137,388 acre-ft. Plans provide for a development of 23,589 hp. and also the erection of a dam 665 ft. x 138 ft., a ditch and pipe line 4½ miles long. The cost of the project is estimated at about $1,500,000.

LOS ANGELES, CAL.—The City Council contemplates the installation of an ornamental street-lighting system on various business streets of the city.

PASADENA, CAL.—The city officials have arranged to purchase the local electric light and power plant now owned by the Southern California Edison Company, at a cost of $515,000.

SANATAQUIN, UTAH.—The installation of an incandescent street-lighting system to consist of about eight 1,000-cp. units is under consideration by the City Council.

TUCSON, ARIZ.—At a recent election bonds for the installation of an ornamental street-lighting system were defeated.

DEL NORTE, COL.—AT an election to be held soon, the proposal to issue $8,500 in bonds for improvements to the municipal electric light plant will be submitted to the voters.

## Canada

VANCOUVER, B. C.—Plans are to be prepared this year for the construction of a hydro-electric plant at Heton Lake, to generate 175,000 hp. The cost of the project is estimated at about $12,000,000.

BRANDON, MAN.—A proposal to develop power for Brandon at Currie's Landing, 8 miles east of the city, will be submitted to the provincial government by the Board of Trade.

WINNIPEG, MAN. — According to the officials of the Manitoba Electric Power Transmission Commission, expenditures amounting to about $600,000 will be made this year on development work, including the construction of a power plant at Virden, to cost about $75,000. J. M. Leamy is commissioner.

BROCKVILLE, ONT.—The Hydro-Electric Power Commission contemplate extensions to the power line along the river road east of Brockville.

KITCHENER, ONT.—Bids are being received by the Kitchener Light Commission for the erection of a new hydro-electric distribution station, rated at 4,500 kw.

MILVERTON, ONT.—In connection with the establishment of a waterworks system in the village, a pumphouse will be erected and two electrically driven pumps, rated at 500 gal. per minute, will be installed. The total cost of the system is estimated at about $100,000. E. A. James Company, 36 Toronto Street, Toronto, are engineers.

PRESTON, ONT.—J. Mickler, architect for the Grand Valley Railway, is placing contracts for materials, etc., in connection with two new power stations.

TORONTO, ONT.—Over $17,000,000 is to be spent on the Provincial power schemes this year, according to supplementary estimates submitted to the Legislature. The greater portion of this, $10,500,000 is for the big development at Chippawa and Queenston; and $2,500,000 will be required for the Port Arthur and Thunder Bay development. Estimates on the other developments are as follows: Niagara system, $1,250,000; Severn system, $50,000; Eugenia and Saugeen system, $475,000; Muskoka system, $40,000; Wasdell system, $90,000; St. Lawrence system, $500,000; Rideau system, $250,000; Central Ontario system, $750,000; Nipissing system, $175,000. Expenditures on account of Province, $177,000. Miscellaneous, $500,000.

WOODSTOCK, ONT.—The Water & Light Commission plans the erection of a substation on Ingersoll Avenue. Mr. Archibald is superintendent.

MONTREAL, QUE.—Plans for the new electrically driven low-level pumping station provide for the initial installation of five 30,000,000-gal. pumps and space for three additional pumping units. Two of these pumps have been ordered and will be in operation this season. A. E. Doucet is director of public works.

REGINA, SASK. — An expenditure of $54,310 has been voted by the City Council, for materials for the proposed extensions to the municipal electric light and power plant.

REGINA, SASK.—Bids have been received by the Minister of Public Works, for the construction of a power house at the Parliament Buildings in Regina.

UNITY, SASK. — Contract has been awarded to G. Janowsky for the construction of a new power house at Unity.

## Miscellaneous

PETERSBURG, ALASKA.—Bonds have been authorized for the construction of an electric light and water plant. The development of a water-power system is also contemplated.

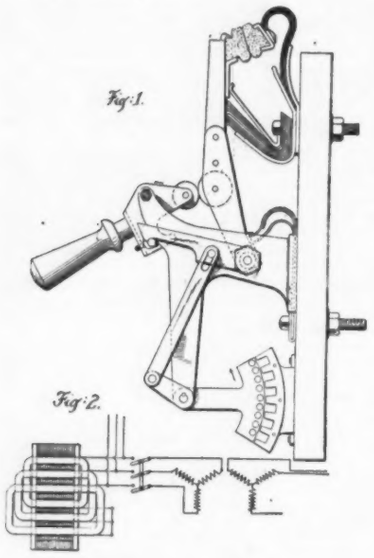
WAILULU, T. H.—A new electric company is being organized for the purpose of establishing an electric distribution system in this place.

(Issued May 11, 1920)

1,339,394. PROTECTION OF ELECTRIC DISTRIBUTION SYSTEM; Philip V. Hunter, Purley, England. App. filed May 6, 1918. Protection of distribution systems in which current transformers connected by pilot wires are employed. The relays, etc., are unaffected by the capacity current.

1,339,456. CIRCUIT CONTROLLER; Clark T. Henderson, Milwaukee, Wis. App. filed June 5, 1915. Circuit-breaker which will not telegraph.

1,339,903. REGENERATING SYSTEM; Friedrich W. Meyer, Pittsburgh, Pa. App. filed March 24, 1915. Electric railway systems for return to source of surplus energy developed.




1,339,981. Circuit Breaker

1,339,914. STARTING MEANS FOR ELECTRIC APPARATUS; Thomas A. Barrett, Englewood, N. J. App. filed March 17, 1917. Method of starting mercury-vapor lamp.

1,339,923. PROTECTIVE MEANS FOR DISTRIBUTING SYSTEMS; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed May 6, 1915. Means for minimizing inductive disturbances on adjacent circuit.

1,339,928. CONTROL FOR SINGLE-PHASE ALTERNATING-CURRENT MOTORS; Rudolf E. Hellmund, Swissvale, Pa. App. filed June 15, 1917. Systems of control for commutator alternating-current motors.

1,339,929. SYSTEM OF CONTROL; Rudolf E. Hellmund, Swissvale, Pa. App. filed April 18, 1917. Electrical and mechanical braking systems.

1,339,930. MOTOR CONTROLLER; Clark T. Henderson, Milwaukee, Wis. App. filed June 29, 1914. For constant speed under varying load.

1,339,936. ELECTRICAL REGULATOR; Allen A. Tirrill, Pittsburgh, Pa. App. filed Sept. 13, 1916. Vibratory-contact voltage regulator.

1,339,945. SYSTEM OF CONTROL; John A. Clarke, Jr., Wilkinsburg, Pa. App. filed April 4, 1916. Control and dynamic braking for electric vehicles.

1,339,966. METHOD OF PRODUCING A RIB ON AN ELECTRICALLY WELED JOINT; Thomas E. Murray, Jr., and Joseph B. Murray, Brooklyn, N. Y. App. filed Nov. 25, 1919. Producing strengthening rib simultaneously with welding.

1,339,967. METHOD OF ELECTRICALLY WELDING METAL BODIES; Thomas E. Murray, Jr., and Joseph B. Murray, Brooklyn, N. Y. App. filed Nov. 25, 1919. Welding by first pressing surfaces together to eliminate irregularities.

1,339,968. METHOD OF ELECTRICAL WELDING; Thomas E. Murray, Jr., and Joseph B. Murray, Brooklyn, N. Y. App. filed Dec. 16, 1919. Welding bushing within flanged plates to form hollow casing.

1,339,969. METHOD OF ELECTRICAL WELDING; Thomas E. Murray, Jr., and Joseph B. Murray, Brooklyn, N. Y. App. filed Dec. 24, 1919. Electrically welding longitudinal edges of a tube.

## *Record of Electrical Patents*

Notes on United States Patents

1,339,970. METHOD OF PRODUCING LONGITUDINAL RIBS ON THE EXTERIORS OF TUBES; Thomas E. Murray, Jr., and Joseph B. Murray, Brooklyn, N. Y. App. filed Dec. 24, 1919. Forms longitudinal ribs on tube by electrically heating portions under pressure.

1,339,971. METHOD OF ELECTRICAL WELDING; Thomas E. Murray, Jr., and Joseph B. Murray, Brooklyn, N. Y. App. filed Jan. 3, 1920. Prevents transverse vibration of edges of hollow object during welding.

1,339,972. METHOD OF ELECTRICAL WELDING; Thomas E. Murray, Jr., and Joseph B. Murray, Brooklyn, N. Y. App. filed Feb. 4, 1920. Seating bodies to be welded in recesses in electrodes.

1,339,981. CIRCUIT BREAKER; Frank W. Roller, East Orange, N. J. App. filed March 19, 1917. Protection against phase reversal and no voltage.

1,339,985. LAMP CONSTRUCTION; Lindsley Schepmoes, Hasbrouck Heights, N. J. App. filed March 16, 1915. Lamp construction for railway carriages.

1,339,987. STEERING-POST BEARING; Grant E. Smith, Poughkeepsie, N. Y. App. filed Aug. 25, 1916. Combined bearing and slip ring for steering-wheel posts.

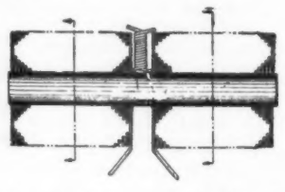
1,339,988. INSULATING COLLECTOR OR DISTRIBUTER SPOOL; Louis Steinberger, Brooklyn, N. Y. App. filed March 20, 1917. High-tension collector for automobiles.

1,339,996. REGULATING SYSTEM; Fred H. Winter, Schenectady, N. Y. App. filed Aug. 13, 1919. To maintain constant voltage or current.

1,339,998. SHAPED FILAMENT; Daniel K. Wright, Paterson, N. J. App. filed April 15, 1914. Metal lamp filaments shaped before mounting.

1,340,004. DYNAMO-ELECTRIC MACHINE; Sven R. Bergman, Nahant, Mass. App. filed June 20, 1918. Dynamo-electric machines for arc welding.

1,340,005. DYNAMO-ELECTRIC MACHINE; Sven R. Bergman, Nahant, Mass. App. filed Aug. 3, 1916. Voltage varies directly with speed.



1,340,027. Electro-Conducting Coil

1,340,027. ELECTRO-CONDUCTING COIL; Chas. W. Dunham, Edgewood Borough, Pa. App. filed March 6, 1917. Coil with terminals on outer surface and adjacent to middle thereof.

1,340,054. INCANDESCENT LAMP; John Judge, New York, N. Y. App. filed June 26, 1919. Reflecting surface inside lamp.

1,340,056. MULTIPLE-ARC WELDING; Otis A. Kenyon, New York, N. Y. App. filed Nov. 19, 1918. Several electrodes operate simultaneously on same weld.

1,340,101. METHOD OF AND MEANS FOR CONTROLLING ELECTRICAL ENERGY; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed June 15, 1914. Control of radio energy.

(Issued May 18, 1920)

1,340,155. PROCESS OF CONTROLLING THE THICKNESS OF WALLS IN AN ELECTRIC FURNACE; Charles H. Chapman, Niagara Falls, N. Y. App. filed Feb. 20, 1917. Forming furnace lining and controlling thickness.

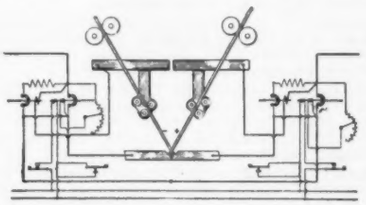
1,340,193. ELECTRICAL OSCILLATOR; Frederick K. Vreeland, Montclair, N. J. App. filed May 15, 1919. Improved purity of wave form secured.

1,340,197. SYSTEM FOR RECORDING ELECTRICAL PHENOMENA; Loren S. Wells, New York, N. Y. App. filed June 21, 1919. Records locations liable to electrolysis.

1,340,203. ELECTRIC FURNACE; Thaddeus F. Baily and Frank T. Cope, Alliance, Ohio. App. filed Aug. 12, 1918. Plurality of resistance elements one above the other equally distribute heat.

1,340,222. GALVANIC CELL; Christiaan A. R. Graamans, Rotterdam, Netherlands. App. filed July 25, 1917. Simplified electrode with depolarizer for wet and dry cells.

1,340,240. HOIST CONTROL; Alexander J. Nicht, Jr., Milwaukee, Wis. App. filed Jan. 30, 1914. Control of hoist motors.



1,340,056. Multiple-Arc Welding

1,340,241. LIQUID RHEOSTAT; Alexander J. Nicht, Jr., Milwaukee, Wis. App. filed Jan. 30, 1914. Liquid rheostat for hoist control.

1,340,249. AUTOMATIC CONTROLLING APPARATUS FOR MIXED DRIVING SYSTEMS; Henri Pieper, Liege, Belgium. App. filed Nov. 29, 1916. Controls power of mixed vehicle-propulsion system.

1,340,260. REGISTERING CIRCUITS FOR COIN BOXES; George K. Thompson, Maplewood, N. J. App. filed Oct. 17, 1918. Coin-registering circuits for telephone.

1,340,269. STORAGE BATTERY; Percy D. Ivey, Guelph, Canada. App. filed Feb. 14, 1919. Transparent container allows density indicator to be seen.

1,340,261. LIGHTING FIXTURE; James T. Thompson, Washington, D. C. App. filed Feb. 18, 1919. Bowl support and shade holder for semi-indirect lighting.

1,340,268. ELECTRIC CONDUCTOR TAKE-UP; Arthur W. Hill, Belmond, Iowa. App. filed June 19, 1919. Rewinding reel for extension light.

1,340,343. DIRECTION INDICATOR; Robert B. Pollock, Los Angeles, Cal. App. filed Dec. 30, 1918. Direction indicator for automobile.

1,340,412. METHOD OF ELECTRICALLY WELDING; Albert Schmidt, Flint, Mich. App. filed July 26, 1918. Welds electrodes to spark plug casings.

1,340,435. COST-KEEPING MACHINE; James W. Bryce, Binghamton, N. Y. App. filed Jan. 22, 1919. For calculating pay of men working at different rates.

1,340,471. VIBRATORY-DIAPHRAGM CONTROLLER; Marshall I. Williamson, Baltimore, Md. App. filed May 13, 1919. Regulates sound volume of telephone receiver.

1,340,499. PICTURE-PROJECTION LAMP; Walter G. Preddey, San Francisco, Cal. App. filed Feb. 11, 1919. For dissolving effects.

1,340,502. APPARATUS AND METHOD FOR RECTIFYING HIGH-TENSION ALTERNATING CURRENT; Walter A. Schmidt, Los Angeles, Cal. App. filed Sept. 15, 1915. For precipitation of suspended matter from gases.

1,340,537. AUTOMOBILE SIGNAL; William Edward F. Gibson and Ida M. James, Port Coquitlam, B. C., Canada. App. filed May 17, 1919. Automobile direction signal.

1,340,550. BATTERY HAND LAMP; Thomas J. Madigan, Brooklyn, N. Y. App. filed Aug. 27, 1919. Unaffected by dripping water.

1,340,575. ELECTRO-IONIC VALVE; Erwin R. Stoekle, New York, N. Y. App. filed Sept. 4, 1917. Improved method of supporting parts.

1,340,588. ELECTRICAL APPARATUS; Julius B. Wantz, Chicago, Ill. App. filed April 29, 1915. Current control for X-ray tube.